U.S.

GEORGIA INSTITUTE OF TECHNOLOGY OFFICE OF CONTRACT ADMINISTRATION

PROJECT ADMINISTRATION DATA SHEET

[x] ORIGINAL

[ ] REVISION NO. ____

Project No. E-26-679 DATE: 7/31/81

Project Director: Dr. B. Kahn School/XXXX Nuclear Engineering

Sponsor: U.S. Nuclear Regulatory Commission

Type Agreement: Contract No. NRC-04-81-187

Award Period: From 7/1/81 To ~~6/30/82~~ ~~3/31/83~~ 9/30/83 (Performance) ____ (Reports)

Sponsor Amount: $64,559* Contracted through:

Cost Sharing: None GTRI/XXXX

Title: Bioaccumulation Factor for P-32 in Edible Fish Tissue

ADMINISTRATIVE DATA OCA CONTACT William F. Brown x4820

1) Sponsor Technical Contact: Dr. Paul Hayes, US Nuclear Regulatory Commission, Office of Nuclear Regulatory Research, Environmental Effects Branch, Washington,D.C. 20555

2) Sponsor Admin./Contractual Contact: Mr. Alonzo Jacobs, Research Contracts Branch, Div. of Contracts, Office of Administration, US Nuclear Regulatory Commission, Washington,D.C. 20555 (301) 427-4365

Reports: See Deliverable Schedule Security Classification: none

Defense Priority Rating: DO-E2

RESTRICTIONS

See Attached Gov't Supplemental Information Sheet for Additional Requirements

Travel: Foreign travel must have prior approval - Contact OCA in each case. Domestic travel requires sponsor approval where total will exceed greater of $500 or 125% of approved proposal budget category.

Equipment: Title vests with

COMMENTS: $64,559 is first year funding of a proposed 3 year project for $[illegible]

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R-2206

GEORGIA INSTITUTE OF TECHNOLOGY OFFICE OF CONTRACT ADMINISTRATION

SPONSORED PROJECT TERMINATION/CLOSEOUT SHEET

Date 1/22/86

Project No. ~~E-25-681~~ (Formerly E-26-679) School/~~Lab~~ ME/NE

Includes Subproject No.(s) G-32-674

Project Director(s) Dr. Bernd Kahn GTRC / ~~GIT~~

Sponsor U. S. Nuclear Regulatory Commission

Title Bioaccumulation Factor For P-32 in Edible Fish Tissue

Effective Completion Date: 9/30/83 (Performance) 9/30/83 (Reports)

Grant/Contract Closeout Actions Remaining:

- [ ] None
- [ ] Final Invoice or Final Fiscal Report Submitted 4/23/85
- [ ] Closing Documents
- [x] Final Report of Inventions
- [x] Govt. Property Inventory & Related Certificate
- [ ] Classified Material Certificate
- [ ] Other

Continues Project No. Continued by Project No.

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Georgia Institute of Technology
A UNIT OF THE UNIVERSITY SYSTEM OF GEORGIA
SCHOOL OF NUCLEAR ENGINEERING AND HEALTH PHYSICS
ATLANTA, GEORGIA 30332

ENVIRONMENTAL RADIATION LABORATORY
205 Old Civil Engineering Building

(404) 894-

October 9, 1981

MEMORANDUM

TO: Paul F. Hayes
Siting and Environmental Branch
Division of Health, Siting and Waste Management

FROM: Bernd Kahn, Director
Environmental Resources Center

SUBJECT: Bioaccumulation of P-32 in Fish
Quarterly Progress Report July 1 - September 30, 1981
(NRC No. 04-91-187, GT No. E-26-679)

After some initial delay, the project was begun on August 24, 1981. In addition to the Principal Investigator, current research participants are Kristin Turgeon, Research Scientist (half time) and David Martini, Biology Graduate Research Assistant (half time). The latter began work on September 22. The effort during the first quarter of the project was devoted to two areas: (1) preparing the laboratory and (2) working with NRC, EPA, and TVA staff in developing the field program.

An area 15' x 19' has been obtained in the basement of the Old Civil Engineering Building for the fish studies. The space has been cleared and arrangements have been made for obtaining water, sewer, and electric connections. Three large 6'-diameter tanks and several smaller aquaria are available for the fish. Telephone conversations have been held with persons at the Southeastern Fish Cultural Laboratory, US Fish and Wildlife Service, Marion AL to obtain catfish and with persons at the Warm Springs National Fish Hatchery, Warm Springs, GA to obtain bluegill for the study. Efforts are underway for comparison of year-round temperatures of Atlanta water and water in Chicamauga Lake.

A meeting to discuss organization of a field study at the Sequoyah Nuclear Power Station was held at Muscle Shoals, AL on July 17. A brief but intensive trial study of approximately eight weeks with sampling at 14-day intervals was proposed. Samples would include water from the waste tanks before discharge, from the diffuser pond, and from Chicamauga Lake, as well as some collected upstream for background measurements. Also to be sampled are algae, plankton, shellfish, bluegill, catfish, and bottom sediment. TVA staff took the general proposal under consideration and agreed to develop detailed plans if TVA management agreed. The samples would be collected by TVA and analyzed by EPA at its Montgomery laboratory.

We were contacted by TVA staff in early September to indicate that the reactor is being shut down for an extended period. Samples of water, sediment cores, zooplankton, and periphyton, blue gill, and catfish, therefore, were collected during the weeks of September 7 and 14 at the discharge of the Sequoyah I plant and sent to the EPA Eastern Environmental Radiation Facility for P-32 analysis. The samples are currently being analyzed.

Our plans for the laboratory study during the next three months consist of furnishing the laboratory space, preparing the flow-through water system for the fish, and establishing conditions for transporting, acclimating, and maintaining the fish. With regard to the field study, the information from the brief test program will be used to plan the study for the more extended period on the basis of analytical capability and observed P-32 levels in various media.

BK/e

cc: K.S. Turgeon
D. Martini
DCA Reports Coordinator

Georgia Institute of Technology
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205 Old Civil Engineering Building
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January 7, 1982

MEMORANDUM

TO: Paul F. Hayes
Siting and Environmental Branch
Division of Health, Siting and Waste Management

FROM: Bernd Kahn, Director
Environmental Resources Center

SUBJECT: Bioaccumulation of P-32 in Fish
Quarterly Progress Report October 1 - December 31, 1981
(NRC No. 04-91-187, GT No. E-26-679)

In the second to fourth months of the project, the Georgia Tech Physical Plant staff installed the two large (6'-dia.) fish tanks and associated water intake and discharge lines, dechlorination column, and scaffolding. Installation is to be completed within two weeks. The tanks have been divided with netting to separate two groups of fish per tank.

Arrangements have been made to obtain channel catfish of appropriate size from the School of Forestry, University of Georgia, Athens, and blue gill from the Amakanata Fish Farm, Calhoun, GA. These fish will be transported to the laboratory as soon as the tanks have been thoroughly flushed and the water-treatment charcoal is installed.

A spectrophotometer has been obtained for phosphorus analyses and reagents are on order. The tissue ashing procedures were tested with fish samples and ashing conditions were selected. The liquid scintillation detector has been calibrated with P-32 for counting with either scintillation cocktail or water (Cherenkov radiation). Optimum windows were selected for each procedure.

Procedures for the project were discussed with Dr. Walter Pasciak, USNRC, during his site visit on November 24, 1981.

The enclosed data were reported by the USEPA Montgomery Laboratory for the environmental samples collected in the cooling pond and in the Tennessee River (Chickamauga Lake) near the effluent discharge point for the TVA Sequoyah Nuclear Power Station. These samples were collected on the basis of a protocol developed by EPA, NRC, TVA, and us (see previous Quarterly Progress Report). The results show readily detectable levels of P-32 in catfish and sunfish from the pond and sunfish from the river, and barely detectable levels in periphyton from the pond. On the basis of an estimated P-32 concentration of 0.1-0.5 pCi/L according to TVA staff, the bioaccumulation factor of the fish in the pond would be several thousand, while that for sunfish in the river would have to be much higher.

TVA and regional NRC staff have just informed us that TVA will discontinue the study because Regulatory staff decided not to require P-32 analysis in its technical specifications. This conclusion is warranted on a generic level in response to our report on P-32 bioaccumulation. That review also suggests, however, that there are circumstances under which much larger bioaccumulation factors occur; hence, it seems most appropriate to emphasize the need for site-specific evaluations of the factor.

We plan to begin the actual fish studies next quarter. The initial effort will be devoted to stable phosphorus determinations.

BK/e

Enclosure

cc: K.S. Turgeon
D. Martini
OCA Reports Coordinator

PSSP#	Description	Location	Date Collected	P-32 pCi/kg,l	Fe55 pCi/kg,l
15986	periphyton	river	9/8/81	<5 pCi/g	<2 pCi/g
15987	"	pond	"	20 ± 60%	<2
15988	zoo plankton	pond	9/8/81	<15	<20
15989	"	river disch.	"	<15	<20
15990	"	river (intake background)	"	<15	<20
16037	catfish flesh	river	9/10/81	<30 pCi/l	<15 pCi/kg
16038	catfish bone & viscera	"	"	<120	<100
16039	sunfish flesh	"	"	<80	<25
16040	sunfish bone & viscera	"	"	<400	<120
16041	catfish flesh	pond	"	275 ± 12%	<15
16042	catfish bone, etc.	"	"	750 ± 17%	100 ± 10%
16109	H_2O unfiltered	pond inflow	9/11/81	<1 pCi/l	<10 pCi/l
16110	H_2O unfiltered	pond - gate	"	<1	<10
16111	H_2O filtered	pond inflow	"	<1	<10
16112	H_2O filtered	pond - gate	"	<1	<10
16186	H_2O unfiltered	pond inflow	9/15/81	<1	<20
16187	H_2O filtered	"	"	<1	<20
16188	H_2O unfiltered	pond - gate	"	<1	<20
16189	H_2O filtered	" "	"	<1	<20
16192	catfish flesh	pond	9/15/81	pCi/kg 125 ± 12%	<15 pCi/kg
16193	catfish bone, etc.	"	"	275 ± 30%	<100
16194	sunfish - whole	"	"	740 ± 15%	<90
16195	catfish flesh	river	"	<30	<15
16196	catfish bone, etc.	"	"	<90	<40
16197	sunfish flesh	"	"	130 ± 20%	<20
16198	sunfish bone, etc.	"	"	330 ± 50%	<90

Continued

RSSP#	Description	Location	Date Collected	P-32 pCi/kg,l	Fe55 pCi/kg,l
15289	zoo plankton	pond	9/17/81	pCi/g 20 ± 90%	<8 pCi/g
16290	"	river (487)	"	20 ± 90%	<2
16291	"	" (483.4)	"	<12	<2
16292	periphyton	river	9/17/81	<2	<2
16293	"	pond	"	15 ± 70%	10 ± 40%
16294	H_2O discharge	waste tank	9/15/81	1500 ± 10%	1300 ± 50%
16295	H_2O composite	"	9/9-15/81	1950 ± 5% pCi/l	500 ± 50%
16406	H_2O composite	waste tank	9/16-22/81	675 ± 10%	2200 ± 15%
16407	H_2O discharge	"	9/22/81	820 ± 10%	1500 ± 15%

E-26-679

April 21, 1982

M E M O R A N D U M

TO: Paul F. Hayes
Siting and Environmental Branch
Division of Health, Siting and Waste Management

FROM: Bernd Kahn, Director
Environmental Resources Center

SUBJECT: Bioaccumulation of P-32 in Fish
Quarterly Progress Report January 1 - March 31, 1982
(NRC No. 04-91-187, GT No. E-26-679)

In this 3-month period, the installation of the laboratory was completed, the first sets of fish were obtained, and procedures were instituted for fish culture and phosphorus intake studies. Channel catfish and bluegill are now in two flow-through systems in the laboratory area.

The main study area consists of two 2-m-dia. tanks; each holds 2,000 L. Each tank is divided by mesh into two fish holding areas. Water from the Atlanta municipal supply is treated in an activated charcoal filter for chlorine removal and flows through each of the tanks in parallel at the rate of 8 L/min. The water is monitored three times daily for temperature, dissolved oxygen, chlorine, pH, and flow rate. Solids are removed from the tanks daily by combined pumping and syphoning.

Channel catfish were obtained from the Whitehall Laboratory at the University of Georgia on January 21, and bluegill were obtained from Amakanata Fish Farm, Calhoun, on February 4. The bluegill have been trained to accept minnows and earthworms, but the catfish feed only on pellets. Aquaria have been set up for the food minnows.

Forty catfish have been tagged, but the process is not satisfactory because infected tag wounds have resulted in mortality. Some tags have also been lost. Tagging consisted of threading a section of marked vinyl tubing onto a piece of monofilament that was drawn through the dorsal musculature and then tied in a loop.

Some fish were lost initially because of water flow fluctuations caused by major water use by the nearby hydrology laboratory. The fluctuations caused either chlorine breakthrough (when parallel water use suddenly decreased) or low dissolved oxygen levels (when parallel water use suddenly increased). This problem has been eliminated through systematic notification of water use changes by hydrology laboratory staff.

Additional fish have been lost recently due to disease. The disease was diagnosed as Ich (Ichthyophthirius multifilis - protozoan). A treatment tank containing malachite green - formalin solution is in use for fish treatment.

Five fish have been dissected to determine tissue wet weights. The samples have been ashed and dissolved for phosphorus analysis.

During the next quarter, priority will be given to phosphorus analysis of fish tissue, formalizing all record-keeping procedures with regard to fish growth and analysis, and selecting a better tagging procedure. A routine procedure for monitoring fish health has been recommended and will be followed. Additional fish will be obtained to initiate the phosphorus uptake study.

BK/e

cc: K.S. Turgeon
D. Martini
OCA Reports Coordinator

E-26-679

Georgia Institute of Technology

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MEMORANDUM

TO: Paul F. Hayes
Siting and Environmental Branch
Division of Health, Siting and Waste Management, USNRC

FROM: Bernd Kahn, Director
Environmental Resources Center

DATE: July 27, 1982

SUBJ: Bioaccumulation of P-32 in Fish
Quarterly Progress Report April 1 - June 30, 1982
(NRC No. 04-91-187, GT No. E-26-679)

The research program was reorganized during this quarter in response to the NRC requirement that experimental work be completed by December 31, 1982. The experimental area in the basement of the Old Civil Engineering Building was modified to accommodate simultaneous studies, and additional laboratory space was obtained in the Nuclear Research Center. Procedures for improved fish maintenance were instituted, based on experience with fish during the past several months. A second set of catfish was obtained and arrangements are under way for obtaining a second set of bluegill. Organ weight measurements and phosphate analyses are in progress.

The new schedule provides for the following four experiments to be undertaken in the period August 1 - December 31:

1) Determination of phosphorus turnover rate and P-32 bioaccumulation factor in edible fish tissue. Approximately 120 catfish and 120 bluegill will be maintained in two flow-through 500-gallon tanks. Their feed will be spiked with P-32 for 70 days and unspiked for the following 70 days. Fish at two food intake levels will be sampled weekly for phosphorus and P-32 measurements. Phosphorus turnover will be calculated from stable phosphorus intake relative to body weight and P-32 accumulation in various tissues; the 70-day depuration period will provide at least an upper limit for the turnover rate.

2) Phosphorus balance in fish. A smaller number of fish will be maintained in 20-gal aquaria to measure phosphorus

intake and excretion relative to accumulation more precisely than in Experiment 1.

3) Influence of environmental factors on phosphorus turnover rate. A set of aquarium studies will be performed to observe the influence of water temperature, amount of food intake, and physico-chemical form of phosphorus on P-32 retention by catfish and bluegill.

4) Non-ingestive intake of phosphorus. Fish exposed to P-32 at controlled phosphate concentrations in water will be analyzed to determine the extent (if any) of P-32 intake at body surfaces by exchange or active transfer mechanisms, the location of intake, and the relation of P-32 accumulation rate to phosphate concentration in water.

The following program has been instituted to maintain fish in good health.

1) A second dechlorination column is being installed to permit water turnover rates of 4 - 7 gal/min in each 500-gal tank.

2) Water circulation in each tank is being improved by an airlift system that will also be used for aquarium studies, and by adding discharge holes to the central standpipe at several elevations.

3) Fish health is being monitored routinely by microscopic examination of surface smears and gill tissue.

4) A different tagging method, utilizing dart tags through the dorsal musculature, is being used to reduce the extent of injury.

5) Water quality monitoring (O_2, Cl_2, pH, T) several times daily has been placed into routine operation.

A set of 75 catfish in the 75 - 225 g range were obtained from the Whitehall Laboratory, U. Ga., on June 22, 1982. The fish were measured, weighed, and tagged on June 28, 1982. The fish are being fed gradually increasing amounts of reprocessed Purina Trout Chow as they become acclimated to the 500-gal tank in which they are being maintained.

The analytical procedure for phosphate in fish tissue by addition of vanadomolybdate and measurement of the blue color at 4,700 Å has been tested and is now in use. Calibration curves were obtained for dilutions prepared over the range of phosphorus in fish tissue and also at the much lower level in water where concentration by evaporation is needed. The standard addition technique is being used to compensate for interferences.

Arrangements have been made to obtain 35 20-gal aquaria for Experiments 2 - 4. The modified plan for flowthrough P-32 studies in the 500-gal tanks has been submitted to the Radiological Safety Office for approval. The P-32 tracer will be obtained in late July.

The enlarged study group will consist of the following graduate student assistants and biologists in the summer quarter:

Name	Department	% time
David Martini	Biology	full time
Susan Dunkerly	Biology	0.5 - time
John Oliver	Health Physics	0.5 - time
David Gerling	Biology	full time

In the next month, bluegill and additional catfish will be obtained. All procedures to be used in the project will be tested, and attempts will be made to improve the tagging system. All four experiments are scheduled to begin in August and September.

cc: S. Dunkerly
R. El-Shinawy
D. Gerling
B. Kahn
D. Martini
J. Oliver
K. Turgeon

E-26-679

GEORGIA INSTITUTE OF TECHNOLOGY
OFFICE OF INTERDISCIPLINARY PROGRAMS
205 OLD CIVIL ENGINEERING BUILDING
ATLANTA, GEORGIA 30332

ENVIRONMENTAL RESOURCES CENTER
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BIOENGINEERING CENTER
(404) 894-2375

MEMORANDUM

TO: Paul F. Hayes
Siting and Environmental Branch
Division of Health, Siting and Waste Management, USNRC

FROM: Bernd Kahn, Director
Environmental Resources Center

DATE: October 14, 1982

SUBJ: Bioaccumulation of P-32 in Fish
Quarterly Progress Report July 1 - September 30, 1982
(NRC No. 04-91-187, GT No. E-26-679)

The main experiment -- determining the uptake of P-32 in feed by catfish and bluegill -- was begun during this period. The fish maintenance program has been developed to the point that 140 fish can be kept in a 500-gallon tank in dechlorinated city water flowing at a rate of 4 - 5 gal/min. Unfortunately, a major fish kill occurred on the eleventh day of the catfish experiment because the flow of water was stopped for 12 hours. The bluegill experiment is continuing. Secondary experiments are being planned for the next quarter concerning (1) uptake of P-32 from water, (2) the P-32 balance to check uptake values in the main experiment, and (3) the impact of environmental factors such as water temperature, type of feed, and amount of feed.

The catfish experiment was begun on August 15 with 69 fish in each half of the tank. The average weight of fish on the east side was 170 g (range, 68 - 284 g); on the west side it was 167 g (range 67 - 267 g). The fish were fed 2 g Purina trout chow per 100 g fish on the east side and one-half as much on the west side, in morning and evening feedings. Each daily batch of feed was spiked by adding water and P-32 solution to the dry feed until it was plastic in consistency; the feed was then extruded with a meat grinder, cut into small pellets, dried, weighed, and fed to the fish. The P-32 levels were increased for successive daily portions so that the daily feeding level per fish remained constant at approximately 0.4 uCi on the east side and 0.2 uCi on the west side. Feeding was for approximately 10-minute periods. Attempts were made to provide only the amount of feed immediately consumed, and to collect any unclaimed pellets.

Sets of three catfish were collected on each side on August 16, 17, 18, and 24 at approximately 8 A.M., and immediately weighed and dissected into 8 portions. The samples were weighed moist, dried at 110° C and weighed, and then ashed at 550° C to a white ash and weighed again. The ash was dissolved in 6 N HCl and diluted to 100 ml with distilled water for phosphorus and P-32 analyses. In a few instances, the portion was divided into several parts for replicate analyses, or dilution was to larger volumes. The P-32 measurement was by Cherenkov radiation detection in an automatic sample-changer liquid scintillation system. Each tissue was measured in duplicate.

Interruption of water flow caused the death of 45 fish on the east side and 35 fish on the west side early in the morning of August 26. Complete samples were collected from 3 dead fish on each side and muscle samples, from 15 others. The fish that remained alive were collected in sets of three on Sept. 1, 10, and 23. The experiment was terminated on the latter date.

Results of the P-32 analyses on the first four sampling dates are summarized in Table 1 in terms of count per minute per g wet weight. The count rate can be converted to pCi by multiplying by approximately 1.5. Phosphorus analysis has been delayed to assure measurements of P-32 before excessive decay occurs. The initial values relative to wet weight indicate that concentrations were similar in muscle and skin, and approximately twice as great in skeleton, head, fin, and gills. The highest levels were in the viscera (which includes undigested feed) and in the fin spines. Note that most internal organs are in the viscera or head portions. The higher feeding levels on the east side resulted in higher tissue levels of P-32.

The bluegill experiment was begun on September 27 with 55 fish on the east side and 51 fish on the west side of the tank. The fish on the east side weighed 122 g on the average (range, 78 - 160 g); the fish on the west side weighed 121 g (86 - 164 g). These fish were fed worms that, one or two days earlier, had been fed Carnation worm feed (3 gm dry wt. per 100 g moist worms) moistened with P-32 and redried. The worms were weighed each evening just before they were fed. Daily portions of the worms were maintained in peat moss. The worms separate themselves from the peat moss when the mixture is placed on a lighted dry surface by coming together in a ball to prevent desiccation. The fish were fed 3 g worms (moist weight) per 100 g fish on the west side, and one-half as much on the east side. The fish were fed for approximately 10 minutes each evening, a sufficient time to assure that the worms were completely consumed.

Two sets of three fish each were collected from each side on September 28, 29, and 30. The bluegill were dissected into muscle, tail fin, gill filaments, skin plus scales, viscera, skeleton (including dorsal and anal fins), and head (including gill arches, pectoral and pelvic fins, and girdles). The experiment will be continued until the week of December 15. Sampling will occur weekly. Feeding P-32 will be discontinued in the week of November 15, after seven weeks, to permit four weeks of depuration observations.

Samples of feed and water are also being retained for phosphorus and P-32 analysis. The flow-through water is checked for water quality. Fish are being measured periodically to determine weight and length.

After initial problems were encountered, fish are now marked successfully. Each fish was branded on its left flank with a copper marker dipped in liquid nitrogen. These three-digit numbers remained over the period of observation in catfish, but tended to fade in bluegill. A nylon dart tag was also inserted behind the high point of the back arch on each fish. Most of these tags have remained on the bluegill; catfish, on the other hand, dislodged most of these tags.

The bluegill promptly consumed all of the offered worms. The initially larger amount of worm food, however, had to be reduced by one-third to the indicated ratio to assure complete consumption by the worms. The catfish generally did not consume the entire 2 g feed per 100 g weight, even when fed twice daily. After the fish kill, the remaining fish had even less appetite.

Earlier experience with epidemics led to a regime of periodic treatment that has so far kept the fish healthy. This consists of treatment with malachite green-formalin against parasites and fungus, and treatment on other days with furanace as an antibiotic. Increased water flow, made possible by adding a second charcoal treatment column to the water supply, may also have helped in maintaining the fish.

Procedures for marking, measuring, and dissecting fish, for processing, and analyzing samples, and for recording data have been systematized. The many samples -- each collection of fish consisted of 6 fish x 8 tissues/fish -- require essentially mass production techniques.

Arrangements are now being made to obtain an additional 50 catfish and 50 bluegill of similar size as in the main experiments. The first of the supplemental experiments, on the direct uptake of P-32 from water by noningestive pathways, is planned for mid-October. Three pairs of catfish and three of bluegill will be exposed unfed for 4-day periods to water that contains approximately 0.2 uCi P-32 per 75 L - aquarium. One of each pair of fish will have its esophagus blocked. The water will be at a relatively high phosphorus concentration of 0.5 mg/L (0.016 millimolar), at pH 7, where HPO_4^{-2} and $H_2PO_4^{-1}$ are at approximately equal concentrations. If P-32 levels in fish tissue indicate significant uptake rates, further experiments will be planned to determine the effect of concentrations and chemical forms of phosphorus in water, and to identify points of intake by the fish. The remaining experiments are being developed for initiation early in November.

The following students are participating in these experiments:

Name	Department	Fraction of time
David Martini, GRA	Biology	1/2
Susan Dunkerly, GRA	Biology	1/3
Robert Hammond, GRA	NE & HP	1/3
Ann Meizner, GRA	NE & HP	1/3
Ruben Uribe, SA	Biology	1/3

Table 1

CATFISH MUSCLE

Fish No.(1)	Date of death, 1982 (hr)	Weight, gm wet	Weight, gm dry	Weight, gm ashed	Sample No.	P-32 Soln. vol., ml.	P-32 Date of counting, 1982 (hr)	P-32 decay fraction	P-32 net c/m(2)	P-32 c/min.g. wet	P, mg/ml	P-32/P, c/min.mg.
351E	08/16	69.1			101	200	09/17(13)	0.209	306	212		
317E	(08)	93.9			17	100	08/31(17)	0.474	4,240	476		
362E		87.4			107	100	09/17(09)	0.212	<2.2	<0.5		
395W		70.9			47	200	09/07(21)	0.336	14.3	6.0		
418W		66.8			16	100	08/31(03)	0.488	15.5	2		
409W		105.3			15	100	08/31(02)	0.488	31.0	3.0		
359E	08/17	78.3			22	200	09/01(10)	0.481	537	142.6		
357E	(08)	32.9			104	100	09/17(03)	0.225	42.2	28.5		
		34.5			109	100	09/17(17)	0.219	49.2	32.6		
		33.1			112	100	09/17(21)	0.218	39.0	27.0		
300E		47.5			100	100	09/17(13)	0.220	535	256		
		52.6			159	100	09/21(14)	0.183	547	284		
421W		95.5			23	200	08/31(18)	0.493	414	87.9		
422W		38.9			44	100	09/03(08)	0.439	18.6	5.4		
		29.3			108	100	09/17(16)	0.219	13.8	10.8		
380W		39.8			24	100	08/31(18)	0.493	157	40.0		
		31.3			103	100	09/16(16)	0.230	85.4	59.3		
		24.6			76	100	09/14(17)	0.252	55.0	44.5		
365E	08/18	70.1			18	100	08/31(18)	0.522	1,518	207		
361E	(08)	119.0			128	100	09/20(16)	0.199	2,627	555		
385E		98.6			160	100	09/21(14)	0.190	1,317	351		
373W		79.9			127	100	09/20(15)	0.199	755	237		
424W		86.1			126	100	09/20(15)	0.199	321	93.7		
398W		49.7			195	100	09/29(07)	0.131	206	158		
307E	08/24	63.3			123	100	09/20(14)	0.264	7,137	2,135		
	(08)	35.6			124	100	09/20(14)	0.264	4,169	2,218		
449E		117.8			135	100	09/21(10)	0.256	2,965	492		
276E		70.6			116	100	09/20(11)	0.269	5,845	1,539		
372W		110.3			125	100	09/20(14)	0.264	1,038	178		
401W		100.7			42	100	09/02(18)	0.627	10,280	814		
416W		88.7			114	100	09/20(11)	0.269	8,040	1,691		

(1) E fish received twice as much feed as W fish, at same specific activity

(2) Duplicate 10-ml samples analyzed for P-32 by Cherenkov counting; 50 minute counts when <200 c/min, 10-min. counts when > 200 c/min

Table 1 (cont'd)

CATFISH SKELETON

Fish No.	Date of death, 1982 (hr)	Weight, gm			Sample No.	P-32					P, mg/ml	P-32/P, c/min.mg.
		wet	dry	ashed		Soln. vol., ml.	Date of counting, 1982 (hr)	decay fraction	net c/m	c/min.g. wet		
351E	08/16	19.0			41	200	09/03(02)	0.423	303	377		
317E	(08)	19.1			11/12	100	08/31(15)	0.476	1,296	712		
362E		19.8			117	100	09/17(20)	0.207	103.2	126		
395W		22.6			7/8	100	08/30(18)	0.498	7.5	3.3		
418W		16.7			118	100	09/17(22)	0.206	6.4	9.3		
409W		21.1			28	200	09/01(04)	0.465	<2.2	<2.2		
359E	08/17	18.4			157	100	09/21(13)	0.182	154	230		
357E	(08)	18.0			158	100	09/24(07)	0.159	28.7	50.1		
300E		16.5			119	100	09/20(12)	0.200	215	326		
421W		17.7			106	200	09/17(05)	0.225	85.3	214		
422W		12.2			130	100	09/22(12)	0.173	<2.2	<5.2		
380W		17.5			131	100	09/22(14)	0.173	52.7	87.0		
365E	08/18	10.4			133	100	09/21(09)	0.191	209	526		
361E	(08)	17.7			122	100	09/20(13)	0.200	727	1,027		
385E		18.1			121	100	09/20(13)	0.200	358	494		
373W		15.7			120	100	09/20(12)	0.200	195	311		
424W		12.6			132	100	09/23(12)	0.173	76.9	176		
398W		7.3			134	100	09/21(10)	0.191	103.6	372		
307E	08/24	17.2			35	100	09/02(16)	0.636	8,480	3,876		
449E	(08)	22.6			129	100	09/21(09)	0.256	707	611		
276E		14.5			115	100	09/20(11)	0.269	2,036	2,610		
372W		26.4			162	100	09/21(14)	0.254	310	231		
401W		24.5			163	100	09/21(14)	0.254	1,323	1,063		
416W		20.7			164	100	09/21(15)	0.254	2,296	2,183		

Table 1 (cont'd)

CATFISH VISCERA

Fish No.	Date of death, 1982(hr)	Weight, gm wet	dry	ashed	Sample No.	P-32 Soln. vol., ml.	Date of counting, 1982 (hr)	decay fraction	net c/m	c/min.g. wet	P, mg/ml	P-32/P, c/min.mg.
351E	08/16	13.0			38	100	09/02(16)	0.298	1,608	2,075		
317E	(08)	31.0			13	100	08/31(15)	0.476	8,340	2,825		
362E		15.5			85	100	09/15(09)	0.233	214	296		
395W		9.8			83	100	09/14(24)	0.237	<2.2	<4.7		
418W		15.6			59	100	09/08(08)	0.328	<2.2	<2.1		
409W		19.8			55	100	09/08(02)	0.332	<2.2	<1.7		
359E	08/17	17.2			78	100	09/15(08)	0.257	384	434		
357E	(08)	21.6			27	100	08/31(14)	0.501	655	303		
300E		18.4			81	100	09/15(09)	0.257	485	513		
421W		17.7			204	100	09/30(16)	0.117	197	476		
422W		11.5			84	100	09/15(01)	0.249	<2.2	<3.8		
380W		21.3			77	100	09/14(19)	0.252	144	134		
365E	08/18	12.3			87	100	09/15(10)	0.256	386	613		
361E	(08)	31.8			192	100	09/30(13)	0.123	2,615	3,343		
385E		19.6			193	100	09/30(13)	0.123	1,468	3,045		
373W		11.8			63	100	09/10(14)	0.320	1,210	1,602		
424W		16.9			79	100	09/15(09)	0.256	314	363		
398W		7.3			62	100	09/10(17)	0.320	243	520		
307E	08/24	30.6			185	100	09/30(12)	0.165	8,526	8,443		
449E	(08)	21.2			156	100	09/21(13)	0.255	1,348	1,247		
276E		16.1			36	100	09/02(16)	0.631	9,050	4,454		
372W		25.3			152	100	09/21(13)	0.254	1,744	1,357		
401W		20.3			75	100	09/10(16)	0.428	9,263	5,331		
416W		29.2			153	100	09/21(13)	0.255	8,818	5,921		

Table 1 (cont'd)

CATFISH FINS

Fish No.	Date of death, 1982 (hr)	Weight, gm wet	dry	ashed	Sample No.	P-32 Soln. vol., ml.	Date of counting, 1982 (hr)	decay fraction	net c/m	c/min.g. wet	P, mg/ml	P-32/P, c/min.mg.
351E	08/16	3.8			58	100	09/08(15)	0.320	131	539		
317E	(08)	7.6			9/10	100	08/31(14)	0.477	680	938		
362E		5.2			166	100	09/24(21)	0.147	26.8	175		
395W		5.6			57	100	09/08(06)	0.330	<2.2	< 6.0		
418W		5.1			52	100	09/07(23)	0.334	<2.2	< 6.5		
409W		5.8			141	100	09/23(13)	0.156	<2.2	<12.2		
359E	08/17	5.6			169	100	09/25(02)	0.152	53.2	312		
357E	(08)	6.1			171	100	09/25(05)	0.152	35.0	189		
300E		6.4			170	100	09/25(03)	0.152	77.0	396		
421W		5.3			30	100	09/01(07)	0.484	132	257		
422W		3.9			lost sample							
380W		5.8			145	100	09/23(14)	0.164	25.9	136		
365E	08/18	2.9			173	100	09/25(09)	0.159	71.6	776		
361E	(08)	7.2			191	100	09/30(13)	0.123	174	982		
385E		5.9			177	100	09/25(15)	0.156	130	706		
373W		5.9			234	100	10/06(18)	0.087	49.6	483		
424W		5.8			174	100	09/25(10)	0.159	45.8	248		
398W		2.1			178	100	09/25(17)	0.156	33.2	507		
307E	08/24	5.5			155	100	09/21(14)	0.255	1,044	3,722		
449E	(08)	6.4			216	100	09/30(19)	0.162	171	825		
276E		3.8			138	100	09/21(11)	0.255	358	1,847		
372W		6.1			184	100	09/28(18)	0.186	83.1	366		
401W		6.5			179	100	09/24(14)	0.220	489	1,710		
416W		5.0			43	100	09/02(18)	0.635	1,850	2,913		

Table 1 (cont'd)

CATFISH GILLS

Fish No.	Date of death, 1982 (hr)	Weight, gm wet	dry	ashed	Sample No.	P-32 Soln. vol., ml.	Date of counting, 1982 (hr)	decay fraction	net c/m	c/min.g. wet	P, mg/ml	P-32/P, c/min.mg.
351E	08/16	1.11			51	100	09/07(22)	0.334	33.6	453		
317E	(08)	2.20			50	100	09/08(14)	0.324	171	1,199		
362E		2.54			94	100	09/16(07)	0.223	20.8	184		
395W		2.10			73	100	09/11(08)	0.285	<2.2	<18		
418W		1.90			90	100	09/15(16)	0.230	<2.2	<25		
409W		1.60			68	100	09/11(03)	0.285	4.8	48		
359E	08/17	2.00			88	100	09/15(03)	0.248	35.2	355		
357E	(08)	1.74			80	100	09/14(20)	0.251	9.8	112		
300E		1.90			98	100	09/16(18)	0.228	47.4	547		
421W		1.80			21	100	08/30(07)	0.538	79.7	412		
422W		1.23			19	100	08/30(03)	0.538	<2.2	<17		
380W		2.50			102	100	09/16(23)	0.228	20.0	175		
365E	08/18	1.10			92	100	09/15(21)	0.250	41.0	745		
361E	(08)	2.28			91	100	09/17(13)	0.231	118.3	1,123		
385E		1.62			82	100	09/14(22)	0.263	102.4	1,202		
373W		1.10			97	200	09/16(17)	0.240	22.4	848		
424W		1.81			93	100	09/16(03)	0.248	37.0	412		
398W		0.53			64	100	09/10(20)	0.320	11.3	333		
307E	08/24	2.20			111	100	09/17(13)	0.310	607	4,450		
449E	(08)	2.11			69	100	09/11(04)	0.422	217	1,219		
276E		0.88			71	100	09/11(07)	0.418	208	2,827		
372W		2.10			110	100	09/17(19)	0.308	61.8	478		
401W		2.04			96	100	09/17(13)	0.310	187	1,478		
416W		1.95			66	100	09/10(14)	0.437	564	3,309		

Table 1 (cont'd)

CATFISH SKIN

Fish No.	Date of death, 1982 (hr)	Weight, gm wet	dry	ashed	Sample No.	P-32 Soln. vol., ml.	Date of counting, 1982 (hr)	decay fraction	net c/m	c/min.g. wet	P, mg/ml	P-32/P, c/min.mg.
351E	08/16	9.8			49	100	09/08(14)	0.324	147	231		
317E	(08)	13.9			37	100	09/02(15)	0.423	572	486		
362E		11.1			105	100	09/17(04)	0.214	34	71.6		
395W		8.7			53	100	09/08(03)	0.331	<2.2	<3.8		
418W		13.5			5/6	100	08/30(15)	0.500	<2.2	<1.6		
409W		10.5			65	100	09/10(21)	0.291	<2.2	<3.6		
359E	08/17	10.6			26	100	09/01(04)	0.487	126	122		
357E	(08)	14.1			67	100	09/10(23)	0.303	40.5	47.4		
300E		11.2			33	100	09/02(15)	0.454	202	199		
421W		10.7			95	100	09/16(16)	0.230	51.8	105		
422W		8.8			99	100	09/16(21)	0.228	8.5	21.2		
380W		11.8			70	100	09/11(05)	0.300	40.9	57.8		
365E	08/18	5.9			89	100	09/15(05)	0.259	81.0	265		
361E	(08)	14.7			61	100	09/10(13)	0.325	461	482		
385E		17.2			150	100	09/21(12)	0.191	228	347		
373W		13.4			208	100	09/29(19)	0.140	84.5	225		
424W		11.0			148	100	09/23(15)	0.172	45.8	121		
398W		5.1			213	100	09/29(21)	0.140	23.5	165		
307E	08/24	10.6			34	100	09/02(15)	0.631	1,996	1,492		
449E	(08)	11.4			113	100	09/17(15)	0.305	306	440		
276E		8.6			48	100	09/08(13)	0.479	84.8	103		
372W		13.1			39	100	09/02(19)	0.631	266	161		
401W		14.3			74	100	09/10(15)	0.428	1,545	1,262		
416W		11.0			72	100	09/10(15)	0.428	1,080	1,147		

Table 1 (cont'd)

CATFISH HEAD

Fish No.	Date of death, 1982 (hr)	Weight, gm wet	dry	ashed	Sample No.	P-32 Soln. vol., ml.	Date of counting, 1982 (hr)	decay fraction	net c/m	c/min.g. wet	P, mg/ml	P-32/P, c/min.mg.
351E	08/16	47.1			14	100	08/31(17)	0.472	1,734	390		
317E	(08)	55.9			46	250	09/08(13)	0.325	1,316	905		
362E		55.6			203	100	09/30(16)	0.111	212	172		
395W		55.5				200	to be counted					
418W		44.3			143	100	09/23(13)	0.157	5.9	4.2		
409W		51.1			29	100	09/01(03)	0.465	19.0	4.0		
359E	08/17	48.4			31	200	09/01(10)	0.481	676	299		
357E	(08)	23.3			25	100	09/01(00)	0.490	116	50.8		
		36.6			187	100	09/28(21)	0.127	54.5	58.6		
300E		17.1			205	100	09/30(17)	0.117	201	502		
		23.8			32	100	09/01(10)	0.481	783	342		
		11.4			188	100	09/28(23)	0.127	158	546		
421W		52.7			196	100	09/30(13)	0.117	270	219		
422W		18.0			144	100	09/23(13)	0.165	5.0	8.4		
		15.8			237	100	10/06(20)	0.087	2.6	9.5		
380W		38.1			189	100	09/28(24)	0.127	113	117		
		23.1			60	200	09/08(16)	0.336	77.2	99.4		
365E	08/18	30.8			209	100	09/30(18)	0.122	519	691		
361E	(08)	58.3			214	100	09/30(19)	0.122	1,680	1,181		
385E		57.3			210	100	09/30(18)	0.122	787	563		
373W		51.5			211	100	09/30(18)	0.122	488	388		
424W		43.8			207	100	09/30(17)	0.122	239	224		
398W		23.8			212	100	09/30(19)	0.122	314	541		
307E	08/24	53.7			181	100	09/24(14)	0.220	10,530	4,457		
449E	(08)	65.8			217	100	09/30(20)	0.162	1,848	867		
276E		34.9			190	100	09/30(12)	0.165	4,303	3,309		
372W		60.2			215	100	09/30(19)	0.162	618	317		
401W		64.1			180	100	09/24(14)	0.220	3,705	1,314		
416W		59.1			45	200	09/18(13)	0.527	8,020	2,575		

Table 1 (cont'd)

CATFISH FIN SPINES

Fish No.	Date of death, 1982 (hr)	Weight, gm wet	dry	ashed	Sample No.	P-32 Soln. vol., ml.	Date of counting, 1982 (hr)	decay fraction	net c/m	c/min.g. wet	P, mg/ml	P-32/P, c/min.mg.
351E	08/16	0.55			54	100	09/08(02)	0.330	53.0	1,460		
317E	(08)	0.68			48	100	09/08(13)	0.322	84.8	1,936		
362E		0.66			165	100	09/24(20)	0.147	11.1	572		
395W		0.59			140	100	09/23(15)	0.156	<2.2	<120		
418W		0.65			56	100	09/08(05)	0.330	<2.2	< 51		
409W		0.63			142	100	09/08(18)	0.322	<2.2	< 54		
359E	08/17	0.60			168	100	09/24(01)	0.161	17.4	901		
357E	(08)	0.80			186	100	09/28(20)	0.127	6.7	330		
300E		0.77			20	100	08/31(06)	0.510	75.9	966		
421W		0.81			167	100	09/24(23)	0.154	10.6	425		
422W		0.44			172	100	09/25(09)	0.151	<2.2	<170		
380W		0.62			40	100	09/02(24)	0.445	16.6	301		
365E	08/18	0.55			147	100	09/24(05)	0.166	38.8	2,125		
361E	(08)	0.81			176	100	09/25(16)	0.156	71.6	2,833		
385E		0.35			161	100	09/24(10)	0.166	20.5	1,764		
373W		0.84			146	100	09/23(24)	0.169	20.9	736		
424W		0.51			175	100	09/25(14)	0.156	12.0	754		
398W		0.29			194	100	09/29(03)	0.132	12.7	1,659		
307E	08/24	0.64			137	100	09/21(10)	0.254	619	19,040		
449E	(08)	0.75			139	100	09/23(13)	0.231	87.5	2,525		
276E		0.49			154	100	09/21(13)	0.255	232	9,284		
372W		0.74			149	100	09/24(07)	0.222	23.5	715		
401W		0.80			151	100	09/21(12)	0.254	92.0	2,264		
416W		0.64			136	100	09/21(10)	0.254	306	9,412		

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MEMORANDUM

TO: Paul F. Hayes
Siting and Environmental Branch
Division of Health, Siting and Waste Management, USNRC

FROM: Bernd Kahn, Director
Environmental Resources Center

DATE: February 4, 1983

SUBJ: Bioaccumulation of P-32 in Fish
Quarterly Progress Report October 1 - December 31, 1982
(NRC No. 04-91-187, GT No. E-26-679)

The following experiments were completed during this quarter:

(1) P-32 uptake and depuration of bluegill given worm feed
(2) P-32 excretion by bluegills
(3) P-32 uptake through non-ingestion pathways in bluegill and catfish

Radioactivity measurements in fish tissue, water, and feces for the above experiments and for the previously terminated study of P-32 uptake of pellet-fed catfish were completed in January, 1983, and are reported here. The remaining work consists of a study of the effects of type of feed, amount of feed, and water temperature on P-32 uptake by bluegill and catfish; measurements of phosphorus concentrations in all samples; and detailed data analysis.

The study of P-32 uptake and depuration in bluegill (see description of experiment initiation in the previous quarterly report) was completed on December 15 according to the accelerated schedule. It consisted of feeding worms spiked with P-32 to bluegill from September 27 until November 16, followed by feeding non-radioactive worms until December 15. The P-32 levels in seven tissues of fish sacrificed in sets of 6 at weekly or more frequent intervals are shown in Table 1. The fish maintained on the west (W) side of the 500-gal tank received twice the amount of worms at the same specific activity as those on the east (E) side. Water temperatures decreased from 22° C at the beginning of the experiment to 15° C at the end.

The average P-32 concentrations in muscle show a rate of increase during feeding and decrease during depuration consistent with the 14.3-day P-32 half life. Levels in tissues of fish fed twice as much P-32 were consistently higher, but not by a factor of two. Tissues other than muscle show generally the same pattern as muscle but at slightly higher concentrations, except that the viscera samples, which include undigested feed, indicate more rapid uptake and depuration. This relatively rapid turnover may affect P-32 turnover in muscle by initially delaying depuration.

Worm feed was spiked with a constant level of P-32 resulting in 1.17 x 10^5 c/min per g (moist weight) of worm, calculated as of the day that the worms were fed to the fish. The P-32 levels measured in the worms are shown in Table 2. The samples before October 3 include a considerable amount of soil; the values obtained are not believed to be appropriate for the worms themselves. Values after October 3 refer to worms separated from the soil in which they lived. The day-to-day variability undoubtedly reflects changes in P-32 uptake by the worms; the average uptake was approximately 4 percent. More uniform ratios of P-32 relative to phosphate are expected.

The P-32 levels in sets of 8 catfish tissues are summarized in Table 3. The water temperature was between 23 and 26° C during the experiment. The data in Tables 1 and 3 have been checked for consistency by comparing wet, dry, and ash weights. A few remaining inconsistent values are indicated by footnote and will be checked against amounts of phosphate when these measurements become available. The pattern of increase during the first 11 days is similar to that for bluegill. As noted in the preceeding quarterly report, interruption of water flow caused a fish kill on August 26, hence data for the surviving fish are suspect. Moreover, beginning September 1, the P-32 tracer level was inadvertently reduced by a factor of two.

The P-32 levels measured in catfish feed pellets in Table 4 averaged 0.95 x 10^5 c/m per g. This value is consistent with the calculated tracer application of 1.09 x 10^5 c/m per g of dry pellet. It is notable that although the catfish feed contained 25 times as much P-32 as the bluegill feed, tissue concentrations of P-32 were only about three times as great.

The wet weights of the catfish and bluegill measured at the beginning of the experiment, at death, and during the experiment at monthly intervals are listed in Table 5a and 5b. These will be used to examine growth as a function of feeding regime. The values will also be compared with the sums of tissue weights to check data reliability.

On six occasions (see dates in Tables 6 and 7), the sets of three bluegill from each of the two sides of the flow-through tank were transferred to 20-gal aquaria on the day before they were killed in order to measure one-day excretion of P-32. Each aquarium held three fish in 24 L of water. Generally, duplicate 4-L water samples were collected per aquarium. The water was evaporated to 100 ml, 10 ml conc. nitric and 2 ml conc. sulfuric acids were added, and the solution was boiled to reduce it to 10 ml. Acid addition and boiling was repeated to obtain a colorless solution. This was diluted to 50 ml and 20 ml aliquots were taken for P-32 analysis. Small amounts of remaining white residue were removed by filtration. The filters were ashed and the residue was dissolved in approximately 3 ml hydrochloric acid and diluted to 50 ml for analyzing duplicate 20-ml aliquots for P-32. Solids were collected from the bottom of the tanks, taken to dryness, ashed, dissolved in hydrochloric acid, and diluted to 100 ml for P-32 analysis in duplicate. On the first occasion (11/09), the entire amount of water (41.5 L) was filtered through 250-μ and 75-μ filters, and 0.5-l fractions were then filtered through 0.45-μ filters.

The P-32 concentrations in water accumulated from the radioactive bluegill in one day are given in Table 6. To compare these values with the concentration in bluegill tissue, multiply by 8 L/fish (14 L/fish on 11/09) and divide by approximately 150 g/fish. Only a few insoluble residues contained detectable P-32. Duplicate water samples in several instances differed considerably, suggesting that much of the P-32 may have been associated with non-homogeneously distributed suspended, possibly colloidal, solids.

The solids collected in the aquaria contained little P-32, as shown in Table 7. The low excretion rate for P-32 indicated by the P-32 concentration of the dissolved and suspended material support the observation that depuration of bluegill was mostly by radioactive decay of P-32.

To determine the extent to which unfed fish accumulate P-32, sets of 6 fish (three per 20-gal aquarium in 48 L water each), previously unfed for two days, were exposed to P-32 dissolved in water for 4 days. The fish were maintained in an aquarium for 2 days and then transferred to a second aquarium with fresh water for 2 more days. To maintain the water at the high phosphorus concentration of 5.0 mg/L with equimolar levels of mono- and di-sodium phosphate at pH 7, 9.66 mg NaH_2PO_4 and 11.43 mg Na_2HPO_4 were added per liter. The water was aerated continuously.

Two of the bluegill and three of the catfish were prevented from swallowing by inserting a 24 French Foley catheter with a 30-cc balloon into the esophagus while the fish were anesthetized. The balloon was partially inflated with water and the channel to the balloon was blocked with a microstopper. The inflation channel was then cut off at the mouth of the fish. The other fish were controls. After initial difficulties with two test fish in maintaining the block while keeping the fish alive, the procedure worked reasonably well in that the blocking device remained in the fish and the fish lived through the 4-day test.

The surprising results in Table 8 show that fish with a blocked esophagus consistently had twice the P-32 tissue concentrations as unblocked fish. With the exception of bluegill viscera and gills, all P-32 concentrations in tissue were well below those in water shown in Table 9. Even on the assumption that the tissue level of P-32 after 4 days of exposure is only 18 percent of the equilibrium level (based on turnover dependent only on P-32 decay), the bioaccumulation factor under equilibrium conditions for direct uptake from water would be of the order of unity.

Plans have been made to expose 24 bluegill and 24 catfish in sets of three to P-32 in either worm or pellet feed in aquaria maintained at three temperatures. This final test series will be performed in two 9-day periods, one in January and one in February. Tissues will be separated as was done before and analyzed for P-32. All stored samples -- approximately 1,500 -- will also be analyzed for phosphate during the remaining period of the project. We plan to request an extension beyond March 31, 1983, to prepare the final report.

The following students are participating in this study:

Name	Department	Fraction of time
David Martini, GRA	Biology	1/2
Susan Dunkerly, GRA	Biology	1/3
Robert Hammond, GRA	NE & HP	1/3
Ann Mizner, GRA	NE & HP	1/3
Ruben Uribe, SA	Biology	1/3
Bonnie Wright, SA	NE & HP	1/5

Table I
P-32 Uptake and Depuration in Bluegill
Muscle

Fish No.(1)	Date of death, 1982 (hr)	Weight,(2) wet	dry	ashed	Sample No.	P-32 Date of counting, 1982 (hr)	decay fraction	net c/min.(3)	c/min.g. wet	P, mg/ml	P-32/P, c/min.mg.
761E	09/28	22.5	4.10	277	285	10/12(18)	0.498	33.0	14.7		
794E	(08)	23.1	3.48	307	326	10/15(05)	0.441	10.6	5.2		
879E		34.3	6.23	398	314	10/14(21)	0.447	22.5	7.3		
499W		16.3	2.42	169	315	10/14(23)	0.447	120	82.3		
708W		30.7	5.53	403	334	10/19(10)	0.360	136	61.5		
787W		29.1	5.75	347	325	10/14(12)	0.456	231	87.0		
684E	09/29	42.3	7.74	470	452	11/02(18)	0.189	69.2	43.3		
859E	(08)	31.8	--	333	443	11/02(17)	0.189	137.	114		
863E		20.9	4.33	254	457	11/03(01)	0.186	54.4	70.0		
608W		27.1	5.67	334	458	11/04(14)	0.173	183.	195		
682W		39.1	7.47	424	444	11/03(11)	0.182	231.	162		
890W		33.8	6.50	394	571	11/09(13)	0.136	233	243		
619E	09/30	37.3	6.54	401	503	11/05(19)	0.170	28.0	22.1		
872E	(08)	39.2	7.52	474	420	10/25(20)	0.291	248	109		
635E		38.0	7.46	468	433	10/26(01)	0.288	381	174		
706W		29.2	5.38	347	451	11/03(14)	0.191	204	183		
704W		32.4	6.61	405	454	11/03(14)	0.191	192	155		
480W		45.9	9.80	610	415	10/25(18)	0.292	429	160		
759E	10/06	24.3	3.85	118(6)	532	11/06(18)	0.218	259	244		
674E	(08)	20.1	4.05	266	584	11/09(15)	0.190	306	401		
762E		28.6	5.94	339	459	11/03(15)	0.254	514	354		
613W		33.4	7.25	417	460	11/03(15)	0.254	646	381		
680W		22.2	4.73	256	466	11/04(11)	0.244	528	487		
792W		32.1	7.12	396	549	11/07(22)	0.206	770	582		
699E	10/12	29.9	5.31	357	597	11/10(12)	0.243	1,167	803		
784E	(08)	35.7	6.88	455	494	11/04(17)	0.322	2,048	891		
733E		21.0	3.59	228	475	11/04(14)	0.325	500	366		
488W		34.2	6.90	398	518	11/04(22)	0.319	1,957	897		
490W		23.0	4.72	302	586	11/09(16)	0.253	766	658		
476W		40.0	8.00	497	523	11/04(22)	0.319	948	371		

(1) W fish received twice as much feed as E fish, at same specific activity (2) Wet and dry weight in gram; ashed weight in mg. (3) Duplicate 20-ml aliquots of 100-ml samples were analyzed for P-32 by Cherenkov counting with 50-min counts when < 200 c/min and 10-min counts when > 200 c/min (4) Tail samples were combined with skeleton samples after 10/19 (5) Month 01 is in 1983 (6) Weight appears to be erroneous

Table 1 cont'd
P-32 Uptake and Depuration in Bluegill
Muscle

Fish No.	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32 Date of counting, 1982 (hr)	P-32 decay fraction	P-32 net c/min	P-32 c/min.g. wet	P, mg/ml	P-32/P, c/min.mg.
769E	10/19	28.4	6.01	351	613	11/17(11)	0.244	1,044	753		
482E	(08)	25.4	5.38	301	617	11/17(13)	0.243	735	595		
677E		21.9	2.79	198	556	11/08(08)	0.379	724	436		
497W		23.4	4.96	287	555	11/08(08)	0.379	1,640	925		
873W		40.2	8.35	416	624	11/17(14)	0.243	2,770	1,418		
607W		39.8	8.00	478	627	11/17(15)	0.243	1,770	915		
876E	10/26	29.4	5.67	332	673	11/23(13)	0.255	1,121	748		
763E	(08)	26.8	5.33	331	654	11/23(11)	0.255	1,118	818		
881E		23.6	5.07	300	695	11/24(06)	0.246	177	152		
785W		33.2	7.05	422	651	11/23(10)	0.256	1,592	937		
716W		33.3	7.23	427	647	11/18(14)	0.325	2,660	1,229		
875W		40.4	8.90	528	646	11/18(14)	0.325	2,450	933		
882E	11/03	22.8	4.37	268	703	11/24(22)	0.351	1,200	750		
456E	(08)	24.1	5.20	298	701	11/24(18)	0.354	1,095	642		
627E		34.7	6.97	448	795	12/10(11)	0.166	1,427	1,239		
858E		38.4	7.86	471	698	11/24(16)	0.356	1,569	574		
722E		36.4	7.68	434	702	11/24(20)	0.352	1,452	567		
884W		34.5	7.21	435	705	11/25(01)	0.349	1,939	805		
672W		25.0	4.53	301	670	11/23(12)	0.375	765	408		
679W		34.3	6.51	430	685	11/24(13)	0.358	2,438	993		
799E	11/09	28.2	5.51	374	717	11/25(21)	0.448	2,213	875		
790E	(08)	41.3	8.91	539	719	11/26(01)	0.444	2,355	642		
486E		23.7	4.04	274	715	11/25(18)	0.451	689	323		
602W		38.1	8.06	489	785	12/03(14)	0.308	1,334	568		
893W		19.5	3.47	267	790	12/10(10)	0.221	1,155	1,342		
798W		43.3	8.74	572	718	11/25(01)	0.466	5,069	1,256		
899E	11/17	23.3	4.58	301	763	12/02(15)	0.477	1,971	887		
713E	(08)	31.2	6.63	412	766	12/02(16)	0.476	2,293	772		
880E		28.4	5.49	360	765	12/02(16)	0.476	1,240	459		
886W		29.8	5.96	379	759	12/02(14)	0.477	3,781	1,330		
622W		41.4	8.63	536	757	12/02(13)	0.477	3,515	890		
698W		37.4	7.29	467	826	12/10(24)	0.317	2,024	854		

Table 1 cont'd
P-32 Uptake and Depuration in Bluegill
Muscle

Fish No.	Date of death, 1982 (hr)	Weight, wet	dry	ashed	Sample No.	P-32 Date of counting, 1982(hr)(5)	decay fraction	net c/min	c/min.g. wet	P, mg/ml	P-32/P, c/min.mg.
782E	11/20	34.6	7.31	444	846	12/12(22)	0.334	1,646	712		
767E	(08)	48.7	10.52	582	849	12/16(10)	0.282	1,406	512		
728E		46.7	10.41	592	848	12/13(01)	0.333	4,081	1,312		
715W		47.7	10.71	605	931	12/22(10)	0.211	1,454	722		
889W		44.5	10.11	596	1017	12/31(24)	0.133	1,283	1,084		
606W		43.2	9.64	548	847	12/12(23)	0.334	1,762	611		
477E	11/24	39.4	8.26	483	876	12/16(20)	0.336	1,671	631		
738E	(08)	31.3	6.39	431	845	12/12(20)	0.408	3,101	1,214		
691E		49.0	10.37	640	881	12/16(22)	0.335	2,467	751		
668W		34.1	7.40	438	878	12/16(21)	0.336	1,856	810		
717W		22.9	5.00	325	932	12/22(10)	0.256	1,372	1,170		
891W		43.5	9.12	583	868	12/16(17)	0.338	1,872	637		
637E	11/30	37.0	7.52	450	853	12/16(11)	0.458	1,785	527		
721E	(08)	24.7	4.88	316	852	12/16(11)	0.458	854	377		
723E		31.5	6.25	385	885	12/16(23)	0.446	1,291	459		
892W		56.5	12.12	720	880	12/16(21)	0.449	4,748	935		
885W		31.7	7.02	406	877	12/16(20)	0.449	2,101	738		
636W		52.2	11.10	670	851	12/16(11)	0.458	3,010	630		
730E	12/07	38.7	8.04	478	898	12/18(03)	0.365	1,670	591		
871E	(08)	32.7	6.64	377	897	12/18(01)	0.367	652	272		
705E		30.4	5.41	367	896	12/17(23)	0.368	720	322		
641W		34.9	7.30	456	900	12/18(09)	0.361	1,664	660		
615W		45.6	8.62	527	895	12/17(22)	0.368	1,919	572		
735W		32.1	6.71	404	901	12/17(08)	0.379	1,556	639		
694E	12/15	24.7	4.44	373	1088	01/14(15)	0.230	236	208		
485E	(08)	38.4	7.36	498	1025	01/01(14)	0.434	784	235		
894E		54.1	11.22	716	1089	01/14(15)	0.230	634	255		
692W		55.0	11.54	677	998	12/30(16)	0.476	1,921	367		
854W		57.0	12.62	748	1090	01/14(15)	0.230	643	245		
630W		35.6	7.63	472	1091	01/14(16)	0.230	353	216		

Table 1 cont'd
P-32 Uptake and Depuration in Bluegill
Skeleton

Fish No.(1)	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32 Date of counting, 1982 (hr)	P-32 decay fraction	P-32 net c/min.	P-32 c/min.g. wet	P, mg/ml	P-32/P, c/min.mg.
761E	09/28	22.4	6.79	2,470	371	10/20(22)	0.334	89.3	59.7		
794E	(08)	23.9	6.84	3,300	310	10/14(06)	0.463	34.7	15.7		
879E		30.0	9.10	2,990	328	10/15(07)	0.439	34.9	13.2		
499W		23.6	6.79	2,870	329	10/15(11)	0.439	302	146		
708W		24.3	6.59	2,580	327	10/14(13)	0.456	191	86.2		
787W		29.7	8.49	2,780	335	10/19(11)	0.360	338	158		
684E	09/29	32.0	9.39	3,370	418	10/25(19)	0.264	160	94.7		
859E	(08)	28.5	8.85	3,230	469	11/04(12)	0.173	222	225		
863E		20.8	6.31	1,540	468	11/03(16)	0.184	120	157		
608W		21.7	6.79	2,020	467	11/04(12)	0.173	212	282		
682W		33.7	10.12	2,540	416	10/25(19)	0.264	491	276		
890W		29.6	8.52	---	484	11/04(14)	0.173	329	321		
619E	09/30	14.6	--	2,210	453	11/02(20)	0.197	31.4	54.6		
872E	(08)	27.0	8.81	3,010	417	10/25(19)	0.277	390	261		
635E		25.1	8.13	2,630	409	10/25(16)	0.279	419	299		
706W		21.4	6.60	2,650	419	10/25(20)	0.291	306	246		
704W		19.1	6.84	1,910	398	10/25(15)	0.279	309	290		
480W		25.1	9.20	3,070	473	11/04(13)	0.182	232	254		
759E	10/06	24.0	6.22	2,260	572	11/09(13)	0.191	280	305		
674E	(08)	22.1	6.82	2,380	491	11/04(16)	0.242	520	486		
762E		26.2	8.27	2,570	471	11/04(12)	0.243	529	415		
613W		20.9	6.52	1,740	598	11/10(12)	0.182	560	736		
680W		16.2	5.20	1,390	449	11/03(13)	0.255	743	899		
792W		22.9	7.48	1,700	567	11/10(10)	0.183	614	733		
699E	10/12	33.9	9.01	3,400	566	11/09(12)	0.255	1,054	610		
784E	(08)	32.8	9.35	2,920	541	11/07(09)	0.283	1,720	926		
733E		22.5	5.59	2,390	447	11/03(12)	0.341	506	330		
488W		20.9	6.70	1,710	564	11/09(11)	0.255	1,399	1,313		
490W		19.2	5.83	1,880	548	11/07(21)	0.277	672	632		
476W		30.4	8.64	3,140	596	11/10(11)	0.244	726	489		

Table 1 cont'd
P-32 Uptake and Depuration in Bluegill
Skeleton

Fish No.	Date of death, 1982 (hr)	Weight, wet	dry	ashed	Sample No.	P-32 Date of counting, 1982 (hr)	decay fraction	net c/min	c/min.g. wet	P, mg/ml	P-32/P, c/min.mg.
769E	10/19	23.2	7.15	1,970	554	11/08(07)	0.380	1,539	873		
482E	(08)	21.4	6.66	1,590	562	11/09(10)	0.360	1,119	726		
677E		19.9	5.50	2,620	594	11/10(11)	0.343	806	590		
497W		18.7	5.39	1,290	553	11/08(05)	0.382	1,645	1,151		
873W		36.9	10.36	2,860	561	11/09(10)	0.360	3,675	1,383		
607W		39.7	11.81	3,720	592	11/09(16)	0.356	2,444	865		
876E	10/26	22.4	7.00	2,060	683	11/23(16)	0.254	1,207	1,061		
763E	(08)	27.5	9.00	3,640	773	12/03(11)	0.158	811	933		
881E		18.1	5.62	1,650	743	12/02(11)	0.165	194	325		
785W		30.8	9.37	3,020	687	11/24(14)	0.243	1,449	968		
716W		34.9	10.56	3,390	688	11/24(14)	0.243	1,981	1,168		
875W		33.0	10.38	3,320	749	12/02(12)	0.165	1,196	1,098		
882E	11/03	23.7	7.00	2,630	788	12/10(09)	0.166	689	876		
456E	(08)	22.7	7.12	1,730	770	12/03(10)	0.232	1,211	1,150		
627E		33.5	9.83	3,420	787	12/10(09)	0.166	1,295	1,164		
858E		32.3	9.93	2,680	678	11/23(15)	0.374	1,855	768		
722E		28.1	8.98	2,050	786	12/10(08)	0.166	802	860		
884W		25.6	8.05	4,210	771	12/03(11)	0.232	1,326	1,116		
672W		24.0	6.96	2,890	747	12/02(12)	0.243	633	543		
679W		34.1	10.31	4,080	793	12/10(11)	0.166	1,131	1,002		
799E	11/09	24.3	7.36	2,630	730	11/26(18)	0.430	2,023	968		
790E	(08)	24.5	8.47	2,090	724	11/26(09)	0.438	2,414	1,126		
486E		26.4	8.07	3,280	767	12/03(09)	0.310	643	393		
602W		27.8	9.47	2,300	731	11/26(20)	0.427	1,765	743		
893W		24.2	8.32	3,750	768	12/03(10)	0.310	1,462	974		
798W		35.2	11.03	3,450	733	11/26(23)	0.425	3,807	1,272		
899E	11/17	29.7	8.31	2,810	822	12/10(17)	0.322	2,013	1,052		
713E	(08)	18.7	6.02	1,610	824	12/10(21)	0.320	1,679	1,403		
880E		25.4	7.64	2,860	817	12/10(15)	0.323	1,002	611		
886W		31.9	9.26	3,000	828	12/11(16)	0.308	3,197	1,627		
622W		30.6	9.06	2,520	835	12/10(22)	0.319	1,154	591		
698W		31.0	9.07	3,200	816	12/10(14)	0.323	2,083	1,040		

Table 1 cont'd
P-32 Uptake and Depuration in Bluegill
Skeleton

Fish No.	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32 Date of counting, 1982 (hr)	P-32 decay fraction	P-32 net c/min	P-32 c/min.g. wet	P, mg/ml	P-32/P, c/min.mg.
782E	11/20	37.5	10.08	3,130	858	12/16(13)	0.281	1,443	685		
767E	(08)	33.8	10.18	3,100	1013	12/31(18)	0.134	654	722		
728E		34.1	10.26	3,290	1016	12/31(23)	0.133	1,038	1,144		
715W		31.1	10.26	3,090	832	12/11(22)	0.351	1,850	847		
889W		40.0	12.00	3,480	834	12/12(02)	0.348	3,993	1,434		
606W		52.8	14.51	3,990	857	12/16(13)	0.281	3,028	1,020		
477E	11/24	30.8	9.68	2,860	875	12/16(20)	0.336	1,419	686		
713E	(08)	23.0	7.38	2,870	856	12/16(12)	0.341	989	630		
691E		29.7	9.52	3,160	936	12/22(12)	0.255	1,374	907		
668W		37.7	11.59	3,640	855	12/16(12)	0.341	1,809	704		
717W		26.7	8.41	2,740	864	12/16(15)	0.339	2,037	1,125		
891W		26.0	8.18	2,830	907	12/18(18)	0.306	1,076	676		
637E	11/30	30.7	9.25	2,930	1043	01/07(12)	0.157	535	555		
721E	(08)	24.0	7.68	2,890	866	12/16(16)	0.452	677	312		
723E		25.4	7.93	2,650	862	12/16(14)	0.456	1,040	449		
892W		45.2	14.97	4,300	867	12/16(17)	0.452	4,706	1,152		
885W		20.9	6.65	1,460	939	12/22(12)	0.341	1,673	1,175		
636W		30.5	10.21	3,440	1035	01/02(06)	0.213	1,025	788		
730E	12/07	26.0	7.97	2,420	1006	12/31(06)	0.314	826	506		
871E	(08)	26.1	7.77	2,210	966	12/23(10)	0.459	523	218		
705E		30.0	8.98	3,570	987	12/23(13)	0.456	444	162		
641W		21.4	6.64	1,840	1000	12/30(20)	0.320	789	576		
615W		28.1	8.54	3,160	979	12/23(12)	0.503	875	310		
735W		27.3	8.31	1,960	1002	12/30(24)	0.318	1,170	674		
694E	12/15	26.1	7.38	3,140	1083	01/07(15)	0.323	299	177		
485E	(08)	33.1	10.08	3,890	1026	01/01(16)	0.432	600	210		
894E		37.4	11.21	3,550	992	12/30(07)	0.484	907	251		
692W		39.1	12.26	3,700	1030	01/01(22)	0.426	1,089	327		
854W		28.3	9.67	2,490	993	12/30(08)	0.483	1,069	391		
630W		26.0	8.11	1,660	1102	01/14(18)	0.229	337	283		

Table 1 cont'd
P-32 Uptake and Depuration in Bluegill
Viscera

Fish No.(1)	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32 Date of counting, 1982 (hr)	P-32 decay fraction	P-32 net c/m(2)	P-32 c/min.g. wet	P, mg/ml	P-32/P, c/min.mg.
761E	09/28	8.4	1.20	104	305	10/13(13)	0.481	747	92.4		
794E	(08)	6.6	1.08	128(6)	288	10/12(22)	0.493	66.2	102		
879E		11.2	2.54	136	343	10/20(00)	0.349	95.6	122		
499W		10.5	1.33	113	301	10/13(12)	0.481	2,515	2,490		
708W		10.9	1.55	119	298	10/13(10)	0.481	3,119	2,970		
787W		16.3	3.56	201	320	10/14(11)	0.458	1,855	1,242		
684E	09/29	8.6	1.55	101	410	10/25(17)	0.279	377	786		
859E	(08)	13.4	1.80	126	374	10/21(13)	0.341	1,518	1,650		
863E		5.7	0.97	60.0	406	10/25(16)	0.279	253	795		
608W		7.2	1.30	68.9	377	10/21(14)	0.341	783	1,595		
682W		9.4	2.60	82.8	368	10/21(13)	0.341	1,071	1,671		
890W		11.3	1.61	110	405	10/25(16)	0.279	1,374	2,180		
619E	09/30	6.4	1.34	67.2	403	10/21(11)	0.360	84.6	184		
872E	(08)	11.1	1.79	128	381	10/25(12)	0.295	1,596	2,440		
635E		11.5	1.75	140	375	10/21(14)	0.358	2,046	2,480		
706W		12.1	1.71	118	404	10/25(16)	0.293	2,390	3,370		
704W		10.0	3.13	88.7	380	10/25(11)	0.295	1,623	2,750		
480W		12.0	2.42	116	369	10/21(13)	0.358	3,077	3,580		
759E	10/06	5.0	0.83	69.4	465	11/03(16)	0.253	1,040	4,110		
674E	(08)	7.9	1.15	90.2	462	11/03(16)	0.253	1,392	3,480		
762E		6.7	1.30	86.9	606	11/17(11)	0.130	458	2,630		
613W		5.6	0.72	---	602	11/10(13)	0.182	770	3,780		
680W		4.6	1.10	55.4	485	11/04(14)	0.242	1,023	4,600		
792W		7.2	2.64	76.1	488	11/04(14)	0.242	1,485	4,260		
699E	10/12	8.7	1.50	126	510	11/04(20)	0.322	1,570	2,800		
784E	(08)	8.9	1.68	105	577	11/09(14)	0.254	1,198	2,650		
733E		4.3	0.65	57.2	516	11/04(21)	0.322	496	1,791		
488W		5.9	1.93	63.3	580	11/09(14)	0.254	925	3,090		
490W		7.0	1.35	73.6	513	11/04(21)	0.322	1,388	3,080		
476W		11.4	1.61	146	537	11/07(02)	0.236	1,590	2,960		

Table 1 cont'd
P-32 Uptake and Depuration in Bluegill
Viscera

Fish No.	Date of death, 1982 (hr)	Weight, wet	dry	ashed	Sample No.	P-32 Date of counting, 1982 (hr)	decay fraction	net c/min	c/min.g. wet	P, mg/ml	P-32/P, c/min.mg.
769E	10/19	6.3	1.41	71.4	615	11/17(12)	0.243	596	1,947		
482E	(08)	5.3	1.63	53.1	614	11/17(12)	0.243	385	1,485		
677E		6.2	0.85	84.6	625	11/17(14)	0.242	294	980		
497W		6.5	1.32	74.6	610	11/17(11)	0.243	695	2,200		
873W		12.1	2.17	151	622	11/17(14)	0.242	1,418	2,420		
607W		14.4	2.30	162	605	11/10(13)	0.341	2,256	2,300		
876E	10/26	7.0	1.53	85.5	692	11/24(15)	0.242	1,213	3,580		
763E	(08)	11.7	1.85	158	699	11/24(16)	0.242	1,468	2,590		
881E		3.9	0.84	44.9	700	11/24(16)	0.242	240	1,271		
785W		11.7	1.98	138	713	11/25(14)	0.231	1,428	2,640		
716W		11.1	1.98	127	640	11/18(13)	0.325	1,847	2,560		
875W		9.2	1.92	114	638	11/18(12)	0.325	1,905	3,180		
882E	11/03	8.1	1.30	86.3	779	12/03(13)	0.231	1,187	3,170		
456E	(08)	4.0	0.95	32.9	775	12/03(12)	0.231	348	1,833		
627E		8.0	1.49	118	804	12/10(12)	0.165	679	2,570		
858E		8.0	2.19	68.5	780	12/03(13)	0.231	799	2,160		
722E		7.3	2.25	56.3	736	12/02(10)	0.243	305	860		
884W		6.4	1.53	77.8	796	12/10(11)	0.165	626	2,960		
672W		8.8	1.16	85.9	776	12/03(12)	0.231	814	2,000		
679W		9.0	1.65	114	778	12/03(13)	0.231	1,456	3,500		
799E	11/09	6.8	1.29	74.5	806	12/10(13)	0.220	907	3,040		
790E	(08)	7.3	2.67	58.2	805	12/10(13)	0.220	608	1,895		
486E		6.4	1.03	64.6	761	12/02(15)	0.323	645	1,543		
602W		7.5	3.61(6)	55.2	762	12/02(15)	0.323	614	1,268		
893W		6.3	1.09	64.9	812	12/10(14)	0.220	853	3,080		
798W		9.3	2.12	107	807	12/10(13)	0.220	1,144	2,800		
899E	11/17	6.9	1.31	79.4	818	12/12(15)	0.293	1,414	3,500		
713E	(08)	5.5	1.18	56.3	821	12/12(16)	0.293	976	3,030		
880E		7.1	1.37	104	1019	01/01(02)	0.114	269	1,662		
886W		14.7	2.49	154	1018	01/01(01)	0.115	851	2,520		
622W		10.6	2.23	108	815	12/10(14)	0.324	3,042	2,970		
698W		9.0	1.73	110	1020	01/01(04)	0.114	573	2,790		

Table 1 cont'd
P-32 Uptake and Depuration in Bluegill
Viscera

Fish No.	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32 Date of counting, 1982 (hr)	P-32 decay fraction	P-32 net c/min	P-32 c/min.g. wet	P, mg/ml	P-32/P, c/min.mg.
782E	11/20	8.7	1.62	95.6	947	12/22(13)	0.210	639	1,749		
767E	(08)	8.6	2.08	92.3	882	12/16(22)	0.275	668	1,412		
728E		8.1	1.74	73.5	948	12/22(13)	0.210	629	1,849		
715W		8.4	1.94	87.9	1022	01/01(09)	0.131	391	1,777		
889W		8.1	1.88	101.5	954	12/22(14)	0.209	578	1,707		
606W		8.7	2.30	81.8	953	12/22(14)	0.209	665	1,829		
477E	11/24	7.8	2.04	83.7	1031	01/01(24)	0.153	284	1,190		
738E	(08)	6.0	1.16	74.6	1041	01/07(11)	0.118	283	1,999		
691E		9.6	2.03	107.5	1040	01/07(11)	0.118	172	759		
668W		9.1	1.78	97.0	943	12/22(13)	0.255	641	1,381		
717W		5.8	1.30	70.8	942	12/22(12)	0.255	548	1,853		
891W		8.1	1.68	94.5	1032	01/02(02)	0.153	362	1,461		
637E	11/30	8.7	1.58	89.5	962	12/22(16)	0.339	397	673		
721E	(08)	5.1	0.90	61.4	892	12/16(06)	0.461	285	605		
723E		6.1	1.17	70.6	890	12/16(23)	0.469	400	735		
892W		16.2	4.19	179.1	964	12/23(10)	0.326	896	847		
885W		5.3	1.89	46.5	961	12/22(15)	0.339	243	677		
636W		12.4	2.24	125	963	12/23(09)	0.326	607	750		
730E	12/07	5.0	1.21	56.5	910	10/18(21)	0.573	272	475		
871E	(08)	6.7	1.63	78.0	984	12/25(01)	0.424	151	266		
705E		9.1	1.51	107.0	981	12/24(22)	0.426	205	264		
641W		5.7	1.39	63.8	982	12/23(13)	0.456	234	450		
615W		8.6	1.36	88.0	972	12/23(11)	0.458	373	473		
735W		5.2	1.22	49.7	983	12/24(24)	0.424	192	435		
694E	12/15	12.0	1.64	144.0	997	12/30(15)	0.476	162	142		
485E	(08)	11.3	1.93	135.0	999	12/30(18)	0.474	183	171		
894E		13.8	2.84	187.0	1024	01/01(12)	0.435	180	150		
692W		13.9	2.96	148.0	1080	01/07(15)	0.323	190	211		
854W		9.6	3.02	94.5	1023	01/01(10)	0.437	158	188		
630W		7.6	2.66	69.4	989	12/30(02)	0.489	112	151		

Table 1 cont'd
P-23 Uptake and Depuration in Bluegill
Skin

Fish No.(1)	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32 Date of counting, 1982 (hr)	P-32 decay fraction	P-32 net c/min.	P-32 c/min.g. wet	P, mg/ml	P-32/P, c/min.mg.
761E	09/28	15.2	5.39	2,160	309	10/14(04)	0.465	113	79.9		
794E	(08)	14.6	6.82	3,570	319	10/15(02)	0.443	37.6	29.1		
879E		18.1	7.02	2,800	321	10/15(04)	0.443	32.4	20.2		
499W		18.0	7.21	3,020	322	10/14(11)	0.456	215	131		
708W		12.7	5.91	2,840	370	10/19(20)	0.353	134	149		
787W		19.2	8.14	3,280	318	10/14(11)	0.456	340	194		
684E	09/29	19.8	7.68	3,150	388	10/25(12)	0.281	150	135		
859E	(08)	17.1	7.00	3,600	396	10/25(14)	0.281	283	294		
863E		12.1	4.25	983(6)	481	11/04(03)	0.176	79.6	187		
608W		14.6	6.00	1,960	474	11/04(13)	0.173	146	289		
682W		18.1	6.45	2,090	399	10/25(15)	0.279	352	349		
890W		16.3	6.44	2,610	608	11/16(20)	0.094	148	483		
619E	09/30	12.6	4.85	1,720	501	11/05(17)	0.171	29.1	67.5		
872E	(08)	20.3	8.39	3,330	389	10/25(12)	0.295	356	297		
635E		16.6	7.34	3,010	414	10/25(18)	0.292	411	424		
706W		17.2	7.03	2,800	411	10/25(18)	0.292	328	327		
704W		14.0	5.38	1,660	401	10/25(15)	0.293	235	286		
480W		18.3	7.85	3,250	432	10/25(24)	0.288	348	330		
759E	10/06	12.0	6.07	2,680	568	11/09(12)	0.191	248	541		
674E	(08)	10.6	4.30	1,650	595	11/10(11)	0.182	365	946		
762E		10.3	5.10	2,150	492	11/04(16)	0.241	373	751		
613W		8.0	3.66	1,270	583	11/09(14)	0.190	445	1,464		
680W		8.0	3.11	838	531	11/06(16)	0.219	442	1,261		
792W		8.8	3.87	1,270	569	11/09(12)	0.191	384	1,142		
699E	10/12	16.7	8.21	3,810	546	11/07(18)	0.278	1,032	1,111		
784E	(08)	14.1	6.23	2,970	502	11/04(19)	0.320	1,244	1,379		
733E		12.8	5.29	1,940	570	11/09(13)	0.255	256	392		
488W		11.4	4.76	1,520	522	11/04(22)	0.319	1,181	1,624		
490W		9.5	3.79	1,440	565	11/09(11)	0.256	536	1,102		
476W		15.8	8.06	3,620	539	11/07(06)	0.285	934	1,037		

Table 1 cont'd
P-32 Uptake and Depuration in Bluegill
Skin

Fish No.	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32 Date of counting, 1982 (hr)	P-32 decay fraction	P-32 net c/min	P-32 c/min.g. wet	P, mg/ml	P-32/P, c/min.mg.
769E	10/19	9.0	4.17	1,510	630	11/17(16)	0.254	690	1,509		
482E	(08)	7.6	3.48	1,090	652	11/23(11)	0.182	326	1,178		
677E		16.1	6.57	2,960	649	11/18(15)	0.230	434	586		
497W		6.6	3.03	1,050	633	11/18(11)	0.232	648	2,120		
873W		13.9	6.28	2,560	653	11/23(11)	0.182	1,088	2,150		
607W		16.9	7.74	3,110	657	11/23(12)	0.182	881	1,432		
876E	10/26	8.0	3.96	1,540	802	12/10(12)	0.112	393	2,190		
763E	(08)	16.0	7.23	3,220	680	11/23(15)	0.254	1,102	1,356		
881E		7.5	3.33	1,130	679	11/23(15)	0.254	246	646		
785W		14.7	6.63	2,680	681	11/23(16)	0.254	1,080	1,446		
716W		15.5	7.76	3,400	689	11/24(14)	0.243	1,137	1,509		
875W		16.6	7.43	3,020	684	11/24(13)	0.243	1,226	1,520		
882E	11/03	13.8	5.64	2,420	723	11/26(07)	0.328	996	1,100		
456E	(08)	8.8	3.40	940	720	11/26(02)	0.331	803	1,378		
627E		17.8	7.56	3,390	746	12/02(11)	0.244	1,321	1,521		
858E		18.5	6.95	2,290	791	12/10(10)	0.166	729	1,187		
722E		9.6	4.23	1,350	774	12/03(12)	0.231	636	1,434		
884W		11.0	4.78	1,810	789	12/10(09)	0.166	651	1,783		
672W		12.5	5.94	2,820	722	11/26(06)	0.329	621	765		
679W		17.4	8.28	3,770	677	11/23(14)	0.374	1,943	1,493		
799E	11/09	12.1	5.22	2,180	728	11/26(14)	0.434	1,548	1,474		
790E	(08)	10.7	5.03	1,650	726	11/26(11)	0.436	1,590	1,705		
486E		15.9	7.16	3,100	734	11/27(01)	0.423	921	684		
602W		12.2	5.62	1,800	729	11/26(16)	0.431	1,100	1,046		
893W		13.1	6.57	3,190	758	12/02(14)	0.324	1,112	1,308		
798W		15.6	7.24	3,060	732	11/26(21)	0.427	2,605	1,955		
899E	11/17	11.7	5.31	2,310	825	12/10(22)	0.319	1,154	1,546		
713E	(08)	8.1	3.37	990	819	12/10(15)	0.323	960	1,835		
880E		13.1	5.55	2,440	829	12/11(18)	0.306	717	894		
886W		16.5	6.82	3,110	831	12/11(21)	0.305	2,529	1,631		
622W		11.0	4.40	1,670	823	12/10(19)	0.320	1,696	2,410		
698W		14.3	6.35	2,930	827	12/11(02)	0.315	1,390	1,543		

Table 1 cont'd
P-32 Uptake and Depuration in Bluegill
Skin

Fish No.	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32 Date of counting, 1982 (hr)	P-32 decay fraction	P-32 net c/min	P-32 c/min.g. wet	P, mg/ml	P-32/P, c/min.mg.
782E	11/20	16.8	6.69	2,850	861	12/16(14)	0.280	1,051	1,117		
767E	(08)	15.9	6.53	2,070	1011	12/31(14)	0.135	533	1,242		
728E		15.9	7.18	3,280	950	12/22(14)	0.209	1,254	1,887		
715W		14.2	6.45	2,760	830	12/11(19)	0.353	1,400	1,396		
889W		21.1	9.08	3,920	833	12/11(24)	0.350	2,783	1,884		
606W		23.4	9.05	3,080	860	12/16(14)	0.280	2,105	1,606		
477E	11/24	15.8	6.77	2,680	1037	01/02(10)	0.150	474	1,000		
738E	(08)	9.8	4.65	2,070	925	12/22(09)	0.257	565	1,122		
691E		13.5	6.14	2,620	1033	01/02(03)	0.152	551	1,343		
668W		18.2	7.86	3,300	865	12/16(15)	0.339	1,346	1,091		
717W		14.4	5.80	2,250	879	12/16(21)	0.336	1,480	1,529		
891W		15.0	6.65	2,800	1036	01/02(08)	0.151	525	1,159		
637E	11/30	15.2	6.50	2,480	935	12/22(11)	0.342	757	729		
721E	(08)	12.8	6.02	2,690	863	12/16(15)	0.453	600	517		
723E		14.0	6.29	2,510	906	12/18(16)	0.411	793	689		
892W		18.4	8.86	3,900	859	12/16(13)	0.456	2,813	1,677		
885W		12.0(6)	3.33	1,080	905	12/18(14)	0.412	1,249	1,263		
636W		13.2	6.60	2,820	934	12/22(11)	0.342	1,084	1,202		
730E	12/07	12.2	4.83	2,000	893	12/17(18)	0.603	1,014	689		
871E	(08)	13.4	4.55	1,660	899	12/18(14)	0.592	486	306		
705E		16.3	7.50	3,680	921	12/19(17)	0.548	506	283		
641W		8.0	3.08	1,130	902	12/18(10)	0.584	778	833		
615W		12.0	5.26	2,550	894	12/17(20)	0.601	775	537		
735W		8.9	3.03	890	903	12/18(11)	0.584	884	850		
694E	12/15	15.2	6.50	3,280	994	12/30(10)	0.481	442	302		
485E	(08)	20.5	8.53	3,790	1010	12/31(13)	0.456	665	356		
894E		18.1	7.19	2,980	995	12/30(12)	0.479	573	330		
692W		19.4	7.85	3,140	1009	12/31(11)	0.458	895	504		
854W		15.9	6.13	2,040	996	12/30(14)	0.477	774	510		
630W		12.6	4.48	1,400	1027	01/01(17)	0.431	406	374		

Table 1 cont'd
P-32 Uptake and Depuration in Bluegill
Gills

Fish No.(1)	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32 Date of counting, 1982 (hr)	P-32 decay fraction	P-32 net c/min.	P-32 c/min.g. wet	P, mg/ml	P-32/P, c/min.mg.
761E	09/28	0.64	0.096	7.7	296	10/13(06)	0.486	8.4	135		
794E	(08)	1.06	0.161	18.5	300	10/13(23)	0.469	<2.2	<22		
879E		0.76	0.138	10.0	339	10/19(18)	0.354	<2.2	<41		
499W		0.91	0.133	9.3	289	10/12(23)	0.493	48.1	536		
708W		0.49	0.081	9.3	313	10/14(19)	0.449	12.7	289		
787W		0.68	0.121	16.1	302	10/14(00)	0.469	44.6	699		
684E	09/29	0.73	0.102	9.5	376	10/21(01)	0.348	13.6	268		
859E	(08)	0.74	0.104	11.5	378	10/21(03)	0.348	37.3	724		
863E		0.37	0.066	3.8	476	11/03(20)	0.179	3.4	257		
608W		0.73	0.107	6.5	603	11/11(03)	0.126	13.1	712		
682W		0.71	0.117	6.0	367	10/19(19)	0.370	35.5	676		
890W		0.71	0.097	5.3	477	11/03(21)	0.179	17.2	677		
619E	09/30	0.51	0.169	10.5	412	10/22(17)	0.338	<2.2	<64		
872E	(08)	1.11	0.157	16.9	373	10/21(00)	0.367	58.7	720		
635E		0.74	---	6.7	366	10/19(17)	0.390	47.6	825		
706W		1.11	0.177	6.4	379	10/21(18)	0.354	56.2	715		
704W		0.80	0.119	10.0	402	10/22(09)	0.344	44.9	816		
480W		1.05	0.153	10.0	384	10/21(23)	0.351	70.5	956		
759E	10/06	0.44	0.073	3.7	575	11/09(22)	0.187	16.8	1,021		
674E	(08)	0.36	0.068	4.6	456	11/02(23)	0.262	37.2	1,972		
762E		0.63	0.110	7.2	508	11/05(20)	0.228	52.2	3,180		
613W		0.52	0.088	6.0	574	11/09(20)	0.188	36.2	1,851		
680W		0.55	0.087	4.7	464	11/03(04)	0.260	55.6	1,944		
792W		0.58	0.102	6.4	470	11/03(18)	0.252	51.8	1,772		
699E	10/12	0.97	0.114	8.0	578	11/10(01)	0.249	84.4	1,747		
784E	(08)	0.79	0.120	12.5	550	11/07(24)	0.274	98.8	2,280		
733E		0.78	0.087	5.2	576	11/09(23)	0.250	24.6	631		
488W		0.69	0.102	5.4	581	11/10(04)	0.247	80.6	2,360		
490W		0.48	0.070	5.2	551	11/08(02)	0.274	44.9	1,707		
476W		0.76	0.102	7.2	573	11/09(18)	0.252	41.4	1,081		

Table 1 cont'd
P-32 Uptake and Depuration in Bluegill
Gills

Fish No.	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32 Date of counting, 1982 (hr)	P-32 decay fraction	P-32 net c/min	P-32 c/min.g. wet	P, mg/ml	P-32/P, c/min.mg.
769E	10/19	0.48	0.058	---	604	11/11(04)	0.315	58.0	1,918		
482E	(08)	0.46	0.080	6.7	588	11/10(17)	0.338	46.7	1,501		
677E		0.77	0.105	9.0	558	11/08(10)	0.378	68.2	1,172		
497W		0.44	0.078	5.7	590	11/10(20)	0.335	68.9	2,340		
873W		0.67	0.101	8.3	591	11/10(22)	0.335	119	2,650		
607W		1.18	0.163	13.8	557	11/08(09)	0.378	192	2,150		
876E	10/26	0.37	0.074	6.7	696	11/24(08)	0.245	32.0	1,765		
763E	(08)	0.71	0.135	10.9	694	11/24(04)	0.248	70.4	1,999		
881E		0.26	0.059	6.9(6)	693	11/24(03)	0.248	11.2	868		
785W		0.88	0.118	7.3	711	11/25(11)	0.232	53.7	1,315		
716W		0.65	0.127	12.5	741	12/01(20)	0.170	48.2	2,180		
875W		0.60	0.161	66.4(6)	697	11/24(09)	0.245	55.3	1,881		
882E	11/03	0.71	0.089	5.0	704	11/24(23)	0.351	67.9	1,362		
456E	(08)	0.40	0.066	3.2	706	11/25(03)	0.351	40.9	1,457		
627E		1.04	0.132	11.2	803	12/10(02)	0.168	65.2	1,866		
858E		0.76	0.123	8.1	738	12/01(15)	0.254	55.6	1,440		
722E		0.65	0.096	5.4	740	12/01(18)	0.252	70.4	2,150		
884W		0.42	0.077	8.5	739	12/01(16)	0.254	33.4	1,565		
672W		0.67	0.071	5.5	794	12/09(18)	0.170	20.2	885		
679W		0.87	0.120	11.6	797	12/09(19)	0.170	44.1	1,488		
799E	11/09	0.47	0.073	7.2	781	12/02(19)	0.320	45.2	1,504		
790E	(08)	0.75	0.114	5.9	783	12/02(22)	0.318	77.8	1,631		
486E		0.65	0.096	4.6	782	12/02(21)	0.318	55.0	1,332		
602W		0.76	0.091	7.5	750	12/02(01)	0.332	54.8	1,086		
893W		0.88	0.120	9.4	737	12/01(13)	0.341	104.	1,735		
798W		0.76	0.092	5.9	784	12/02(24)	0.317	64.0	1,329		
899E	11/17	0.56	0.091	6.0	756	12/02(08)	0.483	128.	2,370		
713E	(08)	0.45	0.061	6.5	753	12/02(04)	0.486	72.1	1,648		
880E		0.64	0.096	7.4	754	12/02(06)	0.486	106.	1,704		
886W		0.67	0.103	9.0	755	12/02(13)	0.479	133.	2,070		
622W		0.63	0.103	9.2	813	12/11(07)	0.312	83.4	2,120		
698W		1.18	0.145	12.7	1021	01/01(07)	0.113	41.6	1,560		

Table 1 cont'd
P-32 Uptake and Depuration in Bluegill
Gills

Fish No.	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32 Date of counting, 1982 (hr)	P-32 decay fraction	P-32 net c/min	P-32 c/min.g. wet	P, mg/ml	P-32/P, c/min.mg.
782E	11/20	0.84	0.116	9.8	883	12/15(18)	0.291	65.1	1,332		
767E	(08)	0.75	0.118	11.4	884	12/15(20)	0.291	52.3	1,198		
728E		0.75	0.105	--	946	12/23(18)	0.198	54.4	1,832		
715W		0.76	0.108	3.7	949	12/23(19)	0.197	44.2	1,476		
889W		1.00	0.146	10.9	951	12/23(21)	0.197	61.4	1,558		
606W		1.18	0.173	5.7	952	12/23(22)	0.196	87.6	1,894		
477E	11/24	0.50	0.080	2.4	888	12/16(01)	0.349	41.0	1,175		
718E	(08)	0.88	0.142	11.4	960	12/24(05)	0.235	55.4	1,339		
691E		0.72	0.112	9.7	889	12/16(02)	0.349	71.7	1,427		
668W		0.81	0.119	8.4	959	12/24(04)	0.236	48.4	1,266		
717W		0.50	0.090	6.1	937	12/22(01)	0.261	46.1	1,766		
891W		1.00	0.146	11.0	938	12/22(03)	0.260	66.9	1,287		
637E	11/30	0.79	0.101	8.2	887	12/15(23)	0.469	52.6	709		
721E	(08)	0.76	0.091	7.0	1039	01/07(18)	0.156	9.9	417		
723E		0.56	0.071	5.8	891	12/16(04)	0.464	26.8	515		
892W		1.65	0.221	19.9	1038	01/02(12)	0.200	55.7	845		
885W		0.47	0.066	6.2	1034	01/02(05)	0.203	13.0	682		
636W		0.90	0.072	4.5	886	12/15(22)	0.518	30.0	355		
730E	12/07	0.61	0.102	9.0	1003	12/31(01)	0.317	24.5	634		
871E	(08)	0.52	0.084	3.6	1005	12/31(04)	0.315	12.4	379		
705E		1.13	0.162	9.8	1001	12/30(22)	0.319	30.4	422		
641W		0.75	0.102	8.8	904	12/18(13)	0.581	40.9	469		
615W		0.80	0.098	5.3	911	12/18(24)	0.568	46.9	516		
735W		0.53	0.070	4.1	1004	12/31(03)	0.315	17.1	512		
694E	12/15	1.04	0.151	10.5	1054	01/11(12)	0.268	12.6	226		
485E	(08)	0.94	0.134	1.2(6)	1101	01/14(07)	0.234	15.2	346		
894E		1.53	0.250	12.4	1098	01/14(02)	0.236	23.4	324		
692W		1.69	0.306	---	1096	01/13(22)	0.238	43.8	544		
854W		0.78	0.151	7.9	990	12/30(04)	0.487	23.9	315		
630W		0.76	0.142	9.7	1081	01/12(19)	0.252	10.5	274		

Table 1 cont'd
P-32 Uptake and Depuration in Bluegill
Head

Fish No.(1)	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32 Date of counting, 1982 (hr)	P-32 decay fraction	P-32 net c/min.	P-32 c/min.g. wet	P, mg/ml	P-32/P, c/min.mg.
761E	09/28	35.9	9.16	3,530	385	10/22(01)	0.317	123	54.0		
794E	(08)	41.2	11.26	4,890	312	10/14(18)	0.452	42.4	11.4		
879E		50.3	14.24	4,660	333	10/15(09)	0.439	42.6	9.6		
499W		46.1	12.39	5,000	323	10/14(12)	0.456	559	133		
708W		34.3	9.91	3,610	324	10/14(12)	0.456	347	111		
787W		42.6	11.40	3,970	394	10/25(14)	0.268	433	190		
684E	09/29	47.3	13.13	4,520	489	11/04(15)	0.172	181	111		
859E	(08)	43.2	11.86	4,470	446	11/03(12)	0.188	335	206		
863E		28.5	8.32	1,980	533	11/06(20)	0.162	140	152		
608W		29.6	9.02	2,640	472	11/04(12)	0.173	291	284		
682W		34.1	13.86	3,340	445	11/03(12)	0.188	408	318		
890W		40.2	10.28	3,790	359	10/21(11)	0.343	904	328		
619E	09/30	32.7	---	---	395	10/22(06)	0.346	77.4	34.2		
872E	(08)	46.2	13.05	4,310	390	10/25(12)	0.295	611	229		
635E		38.6	10.95	---	391	10/25(13)	0.295	658	289		
706W		28.5	7.12	2,590	520	11/06(08)	0.166	222	235		
		14.0	4.13	434(6)	478	11/03(23)	0.187	149	285		
704W		33.9	10.35	2,750	392	10/25(13)	0.295	618	309		
480W		44.8	13.78	4,330	497	11/04(17)	0.180	424	263		
759E	10/06	31.2	9.14	3,400	498	11/04(18)	0.240	569	380		
674E	(08)	33.0	9.34	3,270	500	11/04(18)	0.240	892	563		
762E		33.6	9.59	2,800	493	11/04(16)	0.241	872	538		
613W		26.0	7.69	2,100	593	11/09(16)	0.189	754	767		
680W		25.7	7.28	1,780	609	11/17(11)	0.129	694	1,047		
792W		31.2	10.64	2,330	585	11/09(15)	0.190	954	805		
699E	10/12	48.5	12.96	4,980	526	11/04(23)	0.319	1,563	505		
784E	(08)	48.0	12.89	4,230	547	11/07(19)	0.277	2,543	956		
733E		40.8	10.39	4,320	563	11/09(11)	0.256	684	327		
488W		37.0	10.81	2,600	540	11/07(08)	0.284	2,686	1,298		
490W		32.0	9.07	2,800	560	11/09(10)	0.256	1,626	992		
476W		58.3	16.17	5,510	525	11/04(23)	0.319	1,488	400		

Table 1 cont'd
P-32 Uptake and Depuration in Bluegill
Head

Fish No.	Date of death, 1982 (hr)	Weight, wet	dry	ashed	Sample No.	P-32 Date of counting, 1982 (hr)	decay fraction	net c/min	c/min.g. wet	P, mg/ml	P-32/P, c/min.mg.
769E	10/19	28.1	9.0	2,410	643	11/18(13)	0.231	1,154	889		
482E	(08)	27.5	8.8	2,150	650	11/18(15)	0.230	1,006	795		
677E		36.7	10.0	4,280	634	11/18(11)	0.232	690	405		
497W		26.7	8.1	1,990	635	11/18(12)	0.231	1,504	1,219		
873W		48.8	13.8	3,970	648	11/18(14)	0.231	2,995	1,328		
607W		53.8	15.9	4,880	636	11/22(08)	0.192	1,634	791		
876E	10/26	31.4	9.4	2,660	686	11/24(13)	0.243	1,595	1,045		
763E	(08)	47.0	13.7	5,210	690	11/24(15)	0.242	1,697	746		
881E		24.8	7.5	2,120	644	11/18(04)	0.331	501	305		
785W		42.6	12.7	4,280	801	12/10(12)	0.112	393	412		
716W		42.3	12.7	4,230	682	11/23(16)	0.254	2,016	938		
875W		50.2	15.3	4,670	645	11/18(13)	0.325	2,347	725		
882E	11/03	40.7	11.0	3,990	742	12/02(11)	0.243	1,504	760		
456E	(08)	27.0	8.1	1,970	772	12/03(11)	0.232	1,401	1,118		
627E		51.0	14.3	5,070	691	11/24(15)	0.356	3,620	997		
858E		45.7	13.9	3,590	672	11/23(13)	0.376	2,497	726		
722E		39.2	12.1	2,660	748	12/02(12)	0.243	1,518	797		
884W		33.7	10.3	2,790	721	11/26(04)	0.331	2,251	1,009		
672W		41.5	10.7	4,230	792	12/10(10)	0.166	622	453		
679W		50.9	13.7	5,150	676	11/23(14)	0.375	3,066	803		
799E	11/09	43.9	11.8	3,940	727	11/26(13)	0.434	2,753	723		
790E	(08)	39.4	12.6	2,900	725	11/26(10)	0.436	3,591	1,046		
486E		50.5	13.9	5,300	760	12/02(14)	0.323	1,091	329		
602W		40.0	12.9	3,020	735	11/27(02)	0.422	2,359	700		
893W		45.1	13.4	---	764	12/02(16)	0.323	2,035	700		
798W		54.8	16.3	4,500	769	12/03(10)	0.310	2,650	780		
899E	11/17	41.7	11.1	3,980	820	12/10(16)	0.323	2,544	944		
713E	(08)	28.2	8.0	1,940	837	12/12(07)	0.298	2,382	1,417		
880E		38.4	10.3	3,660	838	12/12(08)	0.298	1,272	556		
886W		61.1	17.1	5,450	909	12/18(21)	0.217	3,444	1,299		
622W		42.9	12.3	3,350	908	12/18(20)	0.217	2,075	1,114		
698W		47.1	12.2	4,050	836	12/12(05)	0.299	2,762	981		

Table 1 cont'd
P-32 Uptake and Depuration in Bluegill
Head

Fish No.	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32 Date of counting, 1982 (hr)	P-32 decay fraction	P-32 net c/min	P-32 c/min.g. wet	P, mg/ml	P-32/P, c/min.mg.
782E	11/20	56.0	14.3	4,440	933	12/22(11)	0.211	1,444	611		
767E	(08)	55.2	15.4	4,190	1014	12/31(20)	0.133	934	636		
728E		48.7	14.5	4,460	843	12/12(17)	0.338	3,507	940		
715W		53.3	16.9	4,550	872	12/16(19)	0.277	2,057	697		
889W		47.1	13.7	4,220	1015	12/31(21)	0.133	1,203	960		
606W		61.2	18.2	5,200	1012	12/31(16)	0.135	1,175	711		
477E	11/24	46.9	14.1	4,160	871	12/16(18)	0.338	1,917	605		
738E	(08)	38.1	10.6	3,820	870	12/16(18)	0.338	1,449	563		
691E		51.5	14.8	4,380	850	12/16(10)	0.343	2,448	693		
668W		54.5	15.0	5,290	839	12/12(10)	0.416	2,793	616		
717W		41.7	12.3	4,030	840	12/12(12)	0.414	3,427	993		
891W		43.9	12.3	3,790	842	12/12(15)	0.412	2,439	674		
637E	11/30	48.9	13.4	3,910	841	12/12(14)	0.554	2,451	452		
721E	(08)	36.9	10.3	3,810	869	12/16(18)	0.451	839	252		
723E		42.9	12.2	3,970	873	12/16(19)	0.451	1,385	358		
892W		74.4	22.4	6,370	874	12/16(19)	0.451	4,551	678		
885W		42.5	12.4	2,490	854	12/16(12)	0.453	3,849	999		
636W		54.6	15.4	4,720	844	12/12(18)	0.547	2,911	488		
730E	12/07	37.4	10.9	3,130	918	01/14(14)	0.157	545	464		
871E	(08)	40.0	11.7	3,180	1007	12/31(08)	0.312	558	224		
705E		53.3	14.9	---	1060	01/07(14)	0.219	378	162		
641W		31.1	9.2	2,250	988	12/23(14)	0.455	1,306	461		
615W		49.5	13.0	4,440	919	12/19(14)	0.552	1,487	272		
735W		32.2	9.5	2,180	916	12/19(09)	0.558	2,064	574		
694E	12/15	48.5	12.9	5,290	1045	01/07(12)	0.325	423	134		
485E	(08)	55.1	15.6	5,650	1028	01/01(19)	0.428	623	132		
894E		53.6	15.4	4,460	1058	01/07(13)	0.325	774	222		
692W		61.2	18.1	5,130	1029	01/01(20)	0.428	1,100	210		
854W		45.4	14.1	2,140	1059	01/07(13)	0.325	940	319		
630W		33.2	10.1	2,140	991	12/30(05)	0.486	910	282		

Table 1 cont'd
P-32 Uptake and Depuration in Bluegill
Tail (4)

Fish No.(1)	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32 Date of counting, 1982 (hr)	P-32 decay fraction	P-32 net c/min.	P-32 c/min.g. wet	P, mg/ml	P-32/P, c/min.mg.
761E	09/28	1.19	0.478	240	455	11/02(22)	0.178	9.4	222		
794E	(08)	1.21	0.517	289	299	10/13(21)	0.472	3.8	33.3		
879E		1.63	0.635	293	292	10/13(03)	0.488	5.2	32.7		
499W		1.61	0.714	372	303	10/14(22)	0.447	40.1	279		
708W		1.31	0.536	261	290	10/13(01)	0.486	25.8	203		
787W		1.75	0.671	333	297	10/13(19)	0.472	54.6	331		
684E	09/29	1.39	0.523	266	382	10/21(20)	0.336	23.5	252		
859E	(08)	1.27	0.488	255	293	10/12(04)	0.538	70.0	512		
863E		0.65	0.240	107	361	10/20(12)	0.358	18.1	389		
608W		0.66	0.283	133	607	11/16(18)	0.096	6.4	505		
682W		1.17	0.407	195	286	10/12(20)	0.520	66.7	548		
890W		1.31	---	225	365	10/20(15)	0.358	54.1	577		
619E	09/30	1.27	0.497	223	387	10/22(04)	0.348	7.3	82.6		
872E	(08)	1.45	0.532	261	362	10/20(14)	0.375	70.5	648		
635E		1.08	0.436	225	383	10/21(21)	0.353	57.3	751		
706W		1.17	0.460	233	413	10/25(09)	0.298	28.7	412		
704W		0.77	0.283	121	407	10/22(12)	0.341	25.8	491		
480W		1.30	0.570	266	408	10/22(14)	0.341	46.9	529		
759E	10/06	1.12	0.487	236	552	11/08(04)	0.214	39.0	814		
674E	(08)	1.08	0.485	231	483	11/04(06)	0.246	62.2	1,171		
762E		1.08	0.416	192	461	11/03(03)	0.260	94.1	1,676		
613W		0.81	0.322	147	587	11/10(15)	0.181	65.1	2,220		
680W		0.78	0.293	117	496	11/05(16)	0.230	71.2	1,984		
792W		0.95	0.351	149	479	11/04(01)	0.249	80.2	1,699		
699E	10/12	1.15	0.444	236	514	11/06(02)	0.301	104	1,502		
784E	(08)	1.60	0.564	290	511	11/04(20)	0.320	178	1,738		
733E		0.99	0.385	210	538	11/07(04)	0.286	47.2	834		
488W		1.01	0.354	170	579	11/10(02)	0.250	131	2,590		
490W		0.90	0.317	160	545	11/07(16)	0.279	96.4	1,920		
476W		1.41	0.534	275	509	11/05(22)	0.303	122	1,428		

Table 1 cont'd
P-32 Uptake and Depuration in Bluegill
Tail (4)

Fish No.(1)	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32 Date of counting, 1982 (hr)	P-32 decay fraction	P-32 net c/min.	P-32 c/min.g. wet	P, mg/ml	P-32/P, c/min.mg.
769E	10/19	0.84	0.310	132	582	11/10(06)	0.346	133.	2,270		
482E	(08)	0.60	0.240	117	600	11/10(24)	0.333	83.1	2,070		
677E		0.88	0.347	173	589	11/10(18)	0.337	73.3	1,236		
497W		0.76	0.276	122	601	11/11(01)	0.332	124.	2,470		
873W		1.31	0.462	210	559	11/08(09)	0.379	283.	2,850		
607W		1.64	0.678	333	599	11/10(12)	0.341	187.	1,672		

Table 2
Bluegill Food

Date of feeding, 1982	Vial No.	Weight, mg. Dry	Ash	amt. fed, g E	W	No. of fish E	W	P-32 counting date, 1982/83	Decay factor	c/min net	c/min.g.
09/27	536	595	---	104.	204	55	51	11/07(01)	0.139	5,217	46,900
28	504	144	---	99.3	196.3	52	48	11/04(19)	0.162	5,917	45,700
29			---	93.9	185.5	49	45				
30	529	160	---	88.5	174.7	46	42	11/04(24)	0.177	5,264	37,200
10/01			---	10.0	32.0	46	42				
02			---	88.5	104.5	46	42				
03	507		16.8	88.5	174.7	46	41	11/04(20)	0.207	1,887	11,380
04				88.5	174.7	46	41				
05	442		---	78.0	120.2	46	41	10/26(03)	0.365	2,269	7,770
06	505		9.4	65.2	92.3	43	38	11/04(19)	0.239	400	2,090
07	506		12.9	78.1	128.	43	38	11/04(19)	0.251	843	4,200
08	530		14.1	78.2	163.	43	38	11/04(24)	0.261	513	2,460
09	527		17.6	78.4	112.5	43	38	11/04(23)	0.275	1,815	8,250
10	535		14.6	78.3	172.	43	38	11/06(23)	0.262	992	4,740
11	534		17.6	78.2	71.0	43	38	11/06(22)	0.275	717	3,260
12	528		13.8	83.1	145.3	40	35	11/04(23)	0.319	655	2,580
13				75.3	65.1	40	35				
14		feed not eaten		0.0	0.0	40	35				
15	1111	301	21.2	83.2	129.5	40	34	01/19(20)	0.0095	19.0	2,500
16	1112	355	24.5	95.1	125.5	40	34	01/19(22)	0.0099	41.8	5,280
17	1113	233	18.2	83.2	110.5	40	34	01/19(24)	0.0104	20.2	2,430
18	1114	305	21.2	83.5	150.2	40	34	01/20(01)	0.0109	16.4	1,880
19	1115	332	21.4	65.2	125.4	37	31	01/20(03)	0.0113	13.8	1,520
20	1116	254	18.4	65.5	155.2	37	31	01/20(04)	0.0119	12.8	1,340
21	1117	320	20.8	55.2	45.4	37	31	01/20(06)	0.0124	47.0	4,790
22	1118	311	21.2	52.5	75.3	37	31	01/20(11)	0.0129	37.5	3,640
23	1119	304	17.5	85.2	125.6	37	31	01/20(12)	0.0135	56.0	5,180
24	1120	292	18.6	90.1	120.5	37	31	01/20(14)	0.0142	38.0	3,340
25	1121	295	17.3	90.0	85.0	37	31	01/20(16)	0.0148	33.2	2,800
26	1122	252	16.3	75.2	84.3	34	28	01/20(17)	0.0155	45.4	3,660
27	1123	273	15.2	65.3	65.7	34	28	01/20(19)	0.0162	51.4	3,960
	1124	300	17.2					01/20(21)	0.0162	69.8	5,380
28	1125	321	17.2	50.3	61.5	34	28	01/20(22)	0.0169	95.4	7,060
29	1126	288	15.8	60.3	120.5	34	28	01/20(24)	0.0177	38.2	2,700
30	1127	264	14.7	90.2	155.0	34	28	01/21(02)	0.0185	63.8	4,310
31	1128	268	14.5	90.	150.	34	28	01/21(03)	0.0194	60.2	3,880

Table 2 cont'd
Bluegill Food

Date of feeding, 1982	Vial No.	Weight, mg		amt. fed, g		No. of fish		P-32			
		Dry	Ash	E	W	E	W	counting date, 1982/83	Decay factor	c/min net	c/min.g.
11/01	1129	287	16.1	85.2	20.1	34	28	01/21(05)	0.020	45.8	2,860
02	1130	232	13.4	80.1	105.2	29	25	01/21(07)	0.021	67.4	4,010
03	1131	219	12.4	65.3	110.5	29	25	01/21(08)	0.022	62.0	3,520
04	1132	279	15.0	40.5	90.2	29	25	01/21(10)	0.023	50.1	2,720
05	1134	212	12.3	71.3	103.4	29	25	01/21(13)	0.024	45.0	2,340
06	1135	254	13.7	61.7	111.8	29	25	01/21(15)	0.025	39.5	1,980
07	1136	297	14.8	50.8	101.3	29	25	01/21(17)	0.027	107.	4,960
08	1137	212	12.3	60.1	81.3	29	25	01/21(18)	0.028	67.2	3,000
09	1138	315	15.1	55.2	85.6	26	22	01/21(20)	0.029	5.6	242
10	1139	282	15.3	42.3	78.2	26	22	01/21(22)	0.030	73.0	3,040
11	1140	374	19.2	40.5	55.3	26	22	01/21(23)	0.032	277.	10,820
12	1141	308	15.8	25.3	42.6	26	22	01/22(01)	0.033	123.	4,660
13	1142	291	15.6	38.5	63.2	26	22	01/22(03)	0.035	133.	4,750
14	1143	243	14.0	50.3	72.6	26	22	01/22(04)	0.036	102.	3,540
15	1144	314	16.5	55.1	85.3	26	22	01/22(06)	0.038	116.	3,820
16	1145	307	16.7	41.3	70.4	26	22	01/22(08)	0.039	117.	3,750

Notes: 1. Feed samples were worms, 2 g moist weight; 20-ml aliquots of 50-ml samples were counted
2. Amount fed is moist weight; total amount was based on estimated fish weight, as 1.5% (E) or 3.0% (W) of body weight. Lesser amounts were fed if fish reduced their intake.

Table 3
P-32 Uptake in Catfish
Muscle

Fish No.(1)	Date of death, 1982 (hr)	Weight, (2) wet	dry	ashed	Sample No.	P-32: Date of counting, 1982 (hr)	decay fraction	net c/min.(3)	c/min.g. wet	P, mg/ml	P-32/P, c/min.mg.
351E	08/16	69.1	17.1	955	101*(4)	09/17(13)	0.209	306	212		
317E	(08)	93.9	--	1,130	17	08/31(17)	0.474	4,240	476		
362E		87.4	18.6	1,170	107	09/17(09)	0.212	199	53.7		
395W		70.9	16.1	841	47*	09/07(21)	0.336	14.3	6.0		
418W		66.8	15.4	601	16	08/31(03)	0.488	15.5	2.4		
409W		105.3	26.3	1,260	15	08/31(02)	0.488	31.0	3.0		
359E	08/17	78.3	18.5	1,360	22*	09/01(10)	0.481	537	143.		
357E	(08)	32.9	10.1	498	104	09/17(03)	0.225	42.2	28.5		
		34.5	9.06	461	109	09/17(17)	0.219	49.2	32.6		
		33.1	8.72	475	112	09/17(21)	0.218	39.0	27.0		
300E		47.5	14.1	664	100	09/17(13)	0.220	535	256		
		52.6	13.4	630	159	09/21(14)	0.183	547	284		
421W		95.5	21.3	1,430	23*	08/31(18)	0.493	414	87.9		
422W		38.9	8.89	430	44	09/03(08)	0.439	18.6	5.4		
		29.3	7.07	383	108	09/17(16)	0.219	13.8	10.8		
380W		39.8	9.50	637	24	08/31(18)	0.493	157	40.0		
		31.3	7.77	420	103	09/16(16)	0.230	85.4	59.3		
		24.6	6.23	---	76	09/14(17)	0.252	55.0	44.5		
365E	08/18	70.1	--	773	18	08/31(18)	0.522	1,518	207		
361E	(08)	119.0	29.1	1,440	128	09/20(16)	0.199	2,627	555		
385E		98.6	24.4	1,110	160	09/21(14)	0.190	1,317	351		
373W		79.9	19.3	1,030	127	09/20(15)	0.199	755	237		
424W		86.1	21.5	1,020	126	09/20(15)	0.199	321	93.7		
398W		49.7	10.0	446	195	09/29(07)	0.131	206	158		
307E	08/24	63.3	16.0	701	123	09/20(14)	0.264	7,137	2,140		
	(08)	35.6	8.78	444	124	09/20(14)	0.264	4,169	2,220		
449E		117.8	28.9	1,490	135	09/21(10)	0.256	2,965	492		
276E		70.6	18.4	838	116	09/20(11)	0.269	5,845	1,539		
372W		110.3	30.3	1,260	125	09/20(14)	0.264	1,038	178		
401W		100.7	19.9	1,180	42	09/02(18)	0.627	10,280	814		
416W		88.7	20.2	1,020	114	09/20(11)	0.269	8,040	1,691		

(1) E fish received twice as much feed as W fish, at same specific activity (2) Wet and dry weight in gram; ashed weight in mg. (3) Duplicate 20-ml aliquots of 100-ml samples were analyzed for P-32 by Cherenkov counting with 50-min. counts when < 200 c/min and 10-min. counts when > 200 c/min. (4) One asterisk indicates a 200-ml solution and two asterisks, 250-ml. (5) Weight appears to be erroneous

Table 3 cont'd
P-32 Uptake in Catfish
Muscle

Fish No.(1)	Date of death, 1982 (hr)	Weight, wet	dry	ashed	Sample No.	P-32 Date of counting, 1982 (hr)	decay fraction	net c/min.	c/min.g. wet	P, mg/ml	P-32/P, c/min.mg.
314E	8/26	45.4	10.9	489	257	10/08(14)	0.123	1,532	1,373		
	(08)	54.2	13.3	597	258	10/08(14)	0.123	1,844	1,384		
369E		57.7	11.9	641	282	10/11(12)	0.107	2,401	1,950		
		47.3	9.89	545	276	10/11(09)	0.107	1,983	1,965		
332E		46.2	10.7	536	279	10/11(10)	0.107	1,324	1,343		
		43.7	10.5	496	278	10/11(10)	0.107	1,002	1,075		
448W		31.5	7.64	383	284	10/12(17)	0.100	189	300		
		43.2	10.0	495	275	10/11(09)	0.107	250	271		
439W		57.0	12.9	647	280	10/11(11)	0.107	2,333	1,918		
		71.0	15.2	784	316	10/14(11)	0.092	2,349	1,790		
389W		57.6	14.8	666	281	10/11(11)	0.107	1,741	1,416		
		64.2	17.4	705	619	11/17(13)	0.018	347	1,493		
355E	9/01	51.4	---	583	261	10/08(15)	0.164	2,242	1,330		
	(08)	33.8	---	576	270	10/08(17)	0.164	2,466	2,220		
393E		77.0	16.5	903	671	11/23(12)	0.018	334	1,205		
348E		33.4	7.68	377	674	11/23(13)	0.018	275	2,290		
		38.0	9.03	430	752	12/02(13)	0.012	211	2,310		
414W		47.2	11.0	536	745	12/01(22)	0.012	98.2	867		
		59.5	---	676	260	10/08(15)	0.164	1,528	783		
403W		49.6	11.1	494	656	11/22(20)	0.018	22.7	127		
404W		65.9	---	759	271	10/08(17)	0.164	1,809	836		
		30.0	6.80	331	675	11/23(14)	0.018	188	1,741		
321E	9/10	83.0	17.9	943	267	10/08(16)	0.254	741	176		
363E	(08)	36.5	8.06	418	197	09/30(15)	0.374	2,083	763		
		54.4	12.2	608	225	09/30(22)	0.370	3,142	780		
356E		25.7	5.44	313	222	09/30(21)	0.370	202	106		
387W		91.8	20.0	1,060	266	10/08(16)	0.254	4,263	914		
429W		74.8	14.6	865	198	09/30(15)	0.374	2,111	377		
431W		79.0	16.4	919	227	09/30(22)	0.370	1,893	324		
428W	9/23	129.1	29.2	1,620	291	10/13(09)	0.379	10,950	1,119		
410W	(08)	91.0	18.8	1,110	272	10/08(17)	0.474	7,943	921		
390W		91.9	20.2	1,080	306	10/13(16)	0.374	1,750	255		

Table 3 cont'd
P-32 Uptake in Catfish
Skeleton

Fish No.	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32 Date of counting, 1982 (hr)	P-32 decay fraction	P-32 net c/min.	P-32 c/min.g. wet	P, mg/ml	P-32/P, c/min.mg.
351E	08/16	19.0	7.17	1,350	41*	09/03(02)	0.423	303	377		
317E	(08)	19.1	7.90	1,460	11/12	08/31(15)	0.476	1,296	712		
362E		19.8	7.44	1,370	117	09/17(20)	0.207	103.2	126		
395W		22.6	8.66	1,760	7/8	08/30(18)	0.498	7.5	3.3		
418W		16.7	7.13	1,110	118	09/17(22)	0.206	6.4	9.3		
409W		21.1	8.79	1,440	28*	09/01(04)	0.465	<2.2	<2.2		
359E	08/17	18.4	7.26	1,220	157	09/21(13)	0.182	154	230		
357E	(08)	18.0	8.09	1,460	158	09/24(07)	0.159	28.7	50.1		
300E		16.5	7.26	1,300	119	09/20(12)	0.200	215	326		
421W		17.7	7.86	1,670	106*	09/17(05)	0.225	85.3	214		
422W		12.2	5.07	926	130	09/22(12)	0.173	<2.2	<5.2		
380W		17.5	7.80	1,670	131	09/22(14)	0.173	52.7	87.0		
365E	08/18	10.4	4.12	732	133	09/21(09)	0.191	209	526		
361E	(08)	17.7	8.03	1,570	122	09/20(13)	0.200	727	1,027		
385E		18.1	8.07	1,330	121	09/20(13)	0.200	358	494		
373W		15.7	6.46	1,200	120	09/20(12)	0.200	195	311		
424W		12.6	5.74	1,000	132	09/23(12)	0.173	76.9	176		
398W		7.3	3.03	599	134	09/21(10)	0.191	103.6	372		
307E	08/24	17.2	6.45	1,250	35	09/02(16)	0.636	8,480	3,880		
449E	(08)	22.6	--	---	129	09/21(09)	0.256	707	611		
276E		14.5	5.88	870	115	09/20(11)	0.269	2,036	2,610		
372W		26.4	11.0	1,630	162	09/21(14)	0.254	310	231		
401W		24.5	9.25	1,680	163	09/21(14)	0.254	1,323	1,063		
416W		20.7	8.07	1,610	164	09/21(15)	0.254	2,296	2,183		

Table 3 cont'd
P-32 Uptake in Catfish
Skeleton

Fish No.	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32 Date of counting, 1982 (hr)	P-32 decay fraction	P-32 net c/min.	P-32 c/min.g. wet	P, mg/ml	P-32/P, c/min.mg
314E	8/26	19.2	7.93	1,270	259	10/08(14)	0.123	1,019	2,160		
369E	(08)	17.5	6.72	1,400	277	10/11(10)	0.118	1,452	3,520		
332E		20.0	7.24	1,400	269	10/08(17)	0.123	583	1,186		
448W		13.5	5.45	1,120	263	10/08(16)	0.123	155	467		
439W		22.2	9.46	1,750	450	11/03(14)	0.035	424	2,710		
389W		20.1	8.87	1,480	262	10/08(15)	0.123	912	1,846		
355E	9/01	23.6	8.58	1,620	256	10/08(13)	0.165	2,121	2,720		
393E	(08)	(20.0)	8.38	1,500	632	11/17(20)	0.023	119	1,290 est.		
348E		17.1	5.97	1,000	631	11/17(16)	0.023	248	3,150		
414W		22.4	8.47	1,580	637	11/17(22)	0.023	102	990		
403W		13.0	4.84	971	668	11/23(23)	0.017	3.4	76.9		
404W		19.4	7.41	1,480	714	11/25(16)	0.016	182	2,930		
321E	9/10	24.1	8.16	1,480	228	09/30(22)	0.368	414	233		
363E	(08)	25.5	8.88	1,400	199	09/30(15)	0.374	4,799	2,520		
356E		8.1	2.64	434	245	10/06(24)	0.274	65.8	148		
387W		22.5	7.81	1,420	229	09/30(23)	0.368	3,007	1,816		
429W		22.4	6.80	1,390	254	10/08(13)	0.255	1,216	1,064		
431W		27.7	9.46	1,700	255	10/21(15)	0.135	347	464		
428W	9/23	26.8	9.89	1,840	274	10/11(09)	0.416	7,913	3,550		
410W	(08)	21.8	7.19	1,300	273	10/21(15)	0.254	2,098	1,894		
390W		25.2	9.42	1,700	283	10/11(12)	0.416	902	430		

Table 3 cont'd
P-32 Uptake in Catfish
Viscera

Fish No.	Date of death, 1982(hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32 Date of counting, 1982 (hr)	P-32 decay fraction	P-32 net c/min.	P-32 c/min.g. wet	P, mg/ml	P-32/P, c/min.mg.
351E	08/16	13.0	3.91	131	38	09/02(16)	0.298	1,608	2,080		
317E	(08)	31.0	9.96	450	13	08/31(15)	0.476	8,340	2,820		
362E		15.5	4.87	---	85	09/15(09)	0.233	214	296		
395W		9.8	2.09	---	83	09/14(24)	0.237	<2.2	<4.7		
418W		15.6	5.43	105	59	09/08(08)	0.328	<2.2	<2.1		
409W		19.8	7.76	141	55	09/08(02)	0.332	<2.2	<1.7		
359E	08/17	17.2	7.14	---	78	09/15(08)	0.257	384	434		
357E	(08)	21.6	9.13	155	27	08/31(14)	0.501	655	303		
300E		18.4	7.65	---	81	09/15(09)	0.257	485	513		
421W		17.7	5.14	253	204	09/30(16)	0.117	197	476		
422W		11.5	4.34	---	84	09/15(01)	0.249	<2.2	<3.8		
380W		21.3	8.43	---	77	09/14(19)	0.252	144	134		
365E	08/18	12.3	4.73	---	87	09/15(10)	0.256	386	613		
361E	(08)	31.8	9.00	339	192	09/30(13)	0.123	2,615	3,340		
385E		19.6	6.56	191	193	09/30(13)	0.123	1,468	3,040		
373W		11.8	3.19	121	63	09/10(14)	0.320	1,210	1,602		
424W		16.9	7.36	---	79	09/15(09)	0.256	314	363		
398W		7.3	2.38	53.2	62	09/10(17)	0.320	243	520		
307E	08/24	30.6	9.86	487	185	09/30(12)	0.165	8,526	8,440		
449E	(08)	21.2	6.75	173	156	09/21(13)	0.255	1,348	1,247		
276E		16.1	6.26	153	36	09/02(16)	0.631	9,050	4,450		
372W		25.3	11.6	183	152	09/21(13)	0.254	1,744	1,357		
401W		20.3	4.57	237	75	09/10(16)	0.428	9,263	5,330		
416W		29.2	9.14	356	153	09/21(13)	0.255	8,818	5,920		

Table 3 cont'd
P-32 Uptake in Catfish
Viscera

Fish No.	Date of death, 1982(hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32 Date of counting, 1982 (hr)	P-32 decay fraction	P-32 net c/min.	P-32 c/min.g. wet	P, mg/ml	P-32/P, c/min.mg.
314E	8/26	40.5	12.9	588	372	10/21(13)	0.066	3,354	6,300		
369E	(08)	33.7	8.55	316	330	10/15(11)	0.089	2,630	3,660		
332E		27.5	6.84	425	363	10/21(12)	0.066	2,189	6,060		
448W		15.5	5.51	116	308	10/13(17)	0.096	206	691		
439W		42.7	11.4	616	360	10/21(12)	0.066	2,970	5,290		
389W		31.7	10.7	391	331	10/15(11)	0.089	2,906	5,170		
355E	9/01	32.9	10.2	267	744	12/01(22)	0.012	83.0	1,051		
393E	(08)	15.2	3.00	158	751	12/02(01)	0.012	55.0	1,508		
348E		26.9	9.01	296	716	11/25(20)	0.016	523	6,080		
414W		23.2	7.75	163	669	11/24(01)	0.017	77.4	981		
403W		12.4	3.23	97.2	639	11/17(23)	0.023	8.9	156		
404W		24.4	7.23	232	707	11/25(04)	0.016	240	3,070		
321E	9/10	15.4	3.63	150	251	10/08(12)	0.255	751	956		
363E	(08)	25.7	6.49	276	344	10/19(12)	0.150	1,374	1,782		
356E		5.8	1.89	42.5	247	10/07(03)	0.273	50.6	160		
378W		26.9	7.11	300	252	10/08(12)	0.255	3,154	2,300		
429W		14.8	3.34	128	236	10/21(15)	0.136	479	1,190		
431W		17.8	3.53	240	221	09/30(20)	0.370	2,362	1,793		
428W	9/23	25.1	8.39	211	336	10/19(11)	0.150	2,221	2,950		
410W	(08)	18.9	6.19	174	357	10/21(11)	0.136	1,029	2,000		
390W		20.1	5.18	219	337	10/19(11)	0.150	931	1,544		

Table 3 cont'd
P-32 Uptake in Catfish
Fins

Fish No.	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32 Date of counting, 1982 (hr)	P-32 decay fraction	P-32 net c/min.	P-32 c/min.g. wet	P, mg/ml	P-32/P, c/min.mg.
351E	08/16	3.8	1.19	244	58	09/08(15)	0.320	131	539		
317E	(08)	7.6	2.63	371	9/10	08/31(14)	0.477	680	938		
362E		5.2	1.78	303	166	09/24(21)	0.147	26.8	175		
395W		5.6	2.24	335	57	09/08(06)	0.330	<2.2	< 6.0		
418W		5.1	2.39	265	52	09/07(23)	0.334	<2.2	< 6.5		
409W		5.8	2.30	359	141	09/23(13)	0.156	<2.2	<12.2		
359E	08/17	5.6	2.05	289	169	09/25(02)	0.152	53.2	312		
357E	(08)	6.1	2.40	351	171	09/25(05)	0.152	35.0	189		
300E		6.4	3.26	389	170	09/25(03)	0.152	77.0	396		
421W		5.3	2.22	398	30	09/01(07)	0.484	132	257		
422W		3.9	1.43	---	lost sample						
380W		5.8	2.67	377	145	09/23(14)	0.164	25.9	136		
365E	08/18	2.9	1.20	188	173	09/25(09)	0.159	71.6	776		
361E	(08)	7.2	2.70	393	191	09/30(13)	0.123	174	982		
385E		5.9	2.75	335	177	09/25(15)	0.156	130	706		
373W		5.9	2.32	379	234	10/06(18)	0.087	49.6	483		
424W		5.8	2.25	306	174	09/25(10)	0.159	45.8	248		
398W		2.1	0.90	133	178	09/25(17)	0.156	33.2	507		
307E	08/24	5.5	2.10	321	155	09/21(14)	0.255	1,044	3,720		
449E	(08)	6.4	2.75	431	216	09/30(19)	0.162	171	825		
276E		3.8	1.70	248	138	09/21(11)	0.255	358	1,847		
372W		6.1	2.62	336	184	09/28(18)	0.186	83.1	366		
401W		6.5	2.97	1,120(5)	179	09/24(14)	0.220	489	1,710		
416W		5.0	1.94	332	43	09/02(18)	0.635	1,850	2,910		

Table 3 cont'd
P-32 Uptake in Catfish
Fins

Fish No.	Date of death, 1982 (hr)	Weight, wet	dry	ashed	Sample No.	P-32 Date of counting, 1982 (hr)	decay fraction	net c/min.	c/min.g. wet	P, mg/ml	P-32/P, c/min.mg.
314E	8/26	6.6	2.69	323	611	11/16(23)	0.018	56.1	2,350		
369E	(08)	5.7	2.03	332	364	10/21(12)	0.066	254	2,930		
332E		5.6	2.02	344	487	11/05(14)	0.031	58.2	1,653		
448W		4.4	1.61	283	710	11/25(10)	0.012	5.3	486		
439W		9.4	3.19	493	490	11/04(15)	0.033	153	2,440		
389W		7.4	3.07	347	393	10/25(13)	0.054	140	1,742		
355E	9/01	6.4	2.71	417	542	11/07(11)	0.039	126	2,520		
393E	(08)	5.2	2.09	357	655	11/22(19)	0.018	26.4	1,410		
348E		7.9(5)	1.38	167	629	11/17(18)	0.023	50.3	1,384		
414W		6.6	3.10	418	524	11/06(11)	0.041	62.1	1,147		
403W		4.0	1.01	170	799	12/09(23)	0.0080	<2.2	<340		
404W		6.1	2.28	323	521	11/06(10)	0.041	113	2,260		
321E	9/10	5.3	1.92	364	218	09/29(22)	0.387	153	373		
363E	(08)	8.1	2.98	409	231	09/30(19)	0.372	763	1,266		
356E		2.2	0.83	152	341	10/19(21)	0.146	18.5	288		
387W		6.9	2.64	408	219	10/01(01)	0.367	993	1,961		
429W		5.1	1.82	351	235	10/21(15)	0.135	188	1,365		
431W		5.8	2.50	357	200	09/30(15)	0.372	288	667		
428W	9/23	7.6	2.68	435	348	10/21(10)	0.256	1,163	2,990		
410W	(08)	5.7	1.85	325	353	10/21(10)	0.256	551	1,888		
390W		4.4	1.69	---	349	10/20(04)	0.273	141	587		

Table 3 cont'd
P-32 Uptake in Catfish
Gills

Fish No.	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32 Date of counting, 1982 (hr)	P-32 decay fraction	P-32 net c/min.	P-32 c/min.g. wet	P, mg/ml	P-32/P, c/min.mg
351E	08/16	1.11	0.227	13.3	51	09/07(22)	0.334	33.6	453		
317E	(08)	2.20	0.453	23.0	50	09/08(14)	0.324	171	1,199		
362E		2.54	0.510	24.1	94	09/16(07)	0.223	20.8	184		
395W		2.10	0.548	--	73	09/11(08)	0.285	<2.2	<18		
418W		1.90	0.322	19.2	90	09/15(16)	0.230	<2.2	<25		
409W		1.60	0.280	16.8	68	09/11(03)	0.285	4.8	48		
359E	08/17	2.00	0.386	23.3	88	09/15(03)	0.248	35.2	355		
357E	(08)	1.74	0.359	--	80	09/14(20)	0.251	9.8	112		
300E		1.90	0.374	16.3	98	09/16(18)	0.228	47.4	547		
421W		1.80	0.345	20.5	21	08/30(07)	0.538	79.7	412		
422W		1.23	0.188	8.2	19	08/30(03)	0.538	<2.2	<17		
380W		2.50	0.497	23.3	102	09/16(23)	0.228	20.0	175		
365E	08/18	1.10	0.174	11.7	92	09/15(21)	0.250	41.0	745		
361E	(08)	2.28	0.486	23.9	91	09/17(13)	0.231	118.3	1,123		
385E		1.62	0.362	--	82	09/14(22)	0.263	102.4	1,202		
373W		1.10	0.250	15.0	97*	09/16(17)	0.240	22.4	848		
424W		1.81	0.379	19.0	93	09/16(03)	0.248	37.0	412		
398W		0.53	0.100	5.4	64	09/10(20)	0.320	11.3	333		
307E	08/24	2.20	0.439	17.6	111	09/17(13)	0.310	607	4,450		
449E	(08)	2.11	0.404	25.0	69	09/11(04)	0.422	217	1,219		
276E		0.88	0.165	8.9	71	09/11(07)	0.418	208	2,830		
372W		2.10	0.458	15.4	110	09/17(19)	0.308	61.8	478		
401W		2.04	0.284	12.0	96	09/17(13)	0.310	187	1,480		
416W		1.95	0.399	23.6	66	09/10(14)	0.437	564	3,310		

Table 3 cont'd
P-32 Uptake in Catfish
Gills

Fish No.	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32 Date of counting, 1982 (hr)	P-32 decay fraction	P-32 net c/min.	P-32 c/min.g. wet	P, mg/ml	P-32/P, c/min.mg.
314E	8/26	1.28	0.214	16.1	618	11/17(02)	0.018	7.3	1,576		
369E	(08)	1.40	0.227	10.9	662	11/23(05)	0.013	6.8	1,821		
332E		1.37	0.202	12.3	482	11/04(05)	0.033	10.2	1,117		
448W		0.85	0.145	9.5	661	11/23(03)	0.013	<2.2	<970		
439W		2.17	0.309	10.7	660	11/23(02)	0.013	8.4	1,451		
389W		1.40	0.211	9.7	659	11/22(24)	0.013	4.0	1,071		
355E	9/01	1.49	0.243	14.0	486	11/05(12)	0.042	32.0	2,560		
393E	(08)	1.65	0.233	15.0	708	11/25(06)	0.016	10.6	2,040		
348E		1.71	0.274	16.2	641	11/18(01)	0.023	26.6	3,380		
414W		2.11	0.395	--	515	11/06(03)	0.041	33.4	1,930		
403W		1.48	0.209	11.6	665	11/23(18)	0.018	<2.2	<410		
404W		2.75	0.354	21.8	798	12/09(21)	0.0081	12.3	2,760		
321E	9/10	2.01	0.325	20.0	224	09/29(24)	0.385	78.5	507		
363E	(08)	2.33	0.407	30.6	238	10/07(14)	0.268	210	1,682		
356E		0.41	0.067	--	358	10/20(10)	0.143	2.1	179		
387W		2.56	0.429	16.4	220	09/30(20)	0.368	383	2,030		
429W		2.32	0.376	22.2	230	09/30(23)	0.368	296	1,734		
431W		2.01	0.306	18.0	241	10/06(23)	0.275	99.0	896		
428W	9/23	3.67	0.557	28.5	347	10/19(12)	0.280	373	1,815		
410W	(08)	3.50	0.509	26.7	356	10/20(09)	0.269	214	1,136		
390W		2.25	0.354	20.3	355	10/20(07)	0.269	86.6	715		

Table 3 cont'd
P-32 Uptake in Catfish
Skin

Fish No.	Date of death, 1982 (hr)	Weight, wet	dry	ashed	Sample No.	P-32 Date of counting, 1982 (hr)	decay fraction	net c/min.	c/min.g. wet	P, mg/ml	P-32/P, c/min.mg
351E	08/16	9.8	3.38	88.8	49	09/08(14)	0.324	147	231		
317E	(08)	13.9	5.02	96.4	37	09/02(15)	0.423	572	486		
362E		11.1	3.94	75.6	105	09/17(04)	0.214	34	71.6		
395W		8.7	2.87	67.1	53	09/08(03)	0.331	<2.2	<3.8		
418W		13.5	5.02	83.9	5/6	08/30(15)	0.500	<2.2	<1.6		
409W		10.5	4.25	113.	65	09/10(21)	0.291	<2.2	<3.6		
359E	08/17	10.6	3.65	79.0	26	09/01(04)	0.487	126	122		
357E	(08)	14.1	5.15	175.	67	09/10(23)	0.303	40.5	47.4		
300E		11.2	4.83	76.6	33	09/02(15)	0.454	202	199		
421W		10.7	3.82	73.7	95	09/16(16)	0.230	51.8	105		
422W		8.8	3.20	60.	99	09/16(21)	0.228	8.5	21.2		
380W		11.8	5.05	102.	70	09/11(05)	0.300	40.9	57.8		
365E	08/18	5.9	2.08	41.1	89	09/15(05)	0.259	81.0	265		
361E	(08)	14.7	5.75	123.	61	09/10(13)	0.325	461	482		
385E		17.2	7.59	135.	150	09/21(12)	0.191	228	347		
373W		13.4	4.69	107.	208	09/29(19)	0.140	84.5	225		
424W		11.0	4.26	90.1	148	09/23(15)	0.172	45.8	121		
398W		5.1	1.86	37.3	213	09/29(21)	0.140	23.5	165		
307E	08/24	10.6	3.35	80.8	34	09/02(15)	0.631	1,996	1,492		
449E	(08)	11.4	3.97	20.5(5)	113	09/17(15)	0.305	306	440		
276E		8.6	3.46	---	86	09/15(09)	0.344	693	1,171		
372W		13.1	4.64	73.1	39	09/02(19)	0.631	266	161		
401W		14.3	5.26	109.	74	09/10(15)	0.428	1,545	1,262		
416W		11.0	3.95	94.0	72	09/10(15)	0.428	1,080	1,147		

Table 3 cont'd
P-32 Uptake in Catfish
Skin

Fish No.	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32: Date of counting, 1982 (hr)	P-32: decay fraction	P-32: net c/min.	P-32: c/min.g. wet	P, mg/ml	P-32/P, c/min.mg
314E	8/26	10.1	3.71	72.0	338	10/19(12)	0.072	256	1,751		
369E	(08)	9.7	2.83	79.4	311	10/14(10)	0.092	322	1,796		
332E		11.9	4.06	95.2	519	11/06(06)	0.030	94.0	1,295		
448W		9.2	3.43	---	620	11/17(04)	0.018	9.3	279		
439W		16.6	5.54	107.	664	11/23(08)	0.013	81.8	1,847		
389W		12.0	4.70	61.3	663	11/23(06)	0.013	32.9	1,028		
355E	9/01	14.8	4.72	104.	517	11/06(05)	0.041	133	1,096		
393E	(08)	13.7	4.60	106.	712	11/25(13)	0.016	41.5	947		
348E		7.9	2.76	37.7	777	12/02(17)	0.011	17.0	978		
414W		15.9	5.87	104.	800	12/09(24)	0.0080	15.7	617		
403W		7.9	2.42	44.6	709	11/25(08)	0.016	2.5	98.9		
404W		10.7	4.18	71.4	463	11/03(16)	0.046	117	1,189		
321E	9/10	10.4	3.15	61.0	253	10/07(05)	0.271	71.2	126		
363E	(08)	13.3	4.68	89.6	233	10/06(08)	0.284	512	678		
356E		3.7	1.25	24.3	265	10/07(07)	0.271	13.6	67.8		
387W		13.3	4.19	107.	249	10/07(20)	0.264	563	802		
429W		9.6	2.91	69.9	264	10/08(16)	0.254	303	621		
431W		15.7	4.63	108.	250	10/08(04)	0.260	259	317		
428W	9/23	18.3	5.97	140.	350	10/21(11)	0.256	902	963		
410W	(08)	11.1	3.13	80.6	346	10/19(12)	0.281	384	616		
390W		12.8	4.54	80.0	354	10/21(11)	0.256	146	223		

Table 3 cont'd
P-32 Uptake in Catfish
Head

Fish No.	Date of death, 1982 (hr)	Weight, wet	dry	ashed	Sample No.	P-32 Date of counting, 1982 (hr)	decay fraction	net c/min.	c/min.g. wet	P, mg/ml	P-32/P, c/min.mg.
351E	08/16	47.1	16.3	4,510	14	08/31(17)	0.472	1,734	390		
317E	(08)	55.9	21.5	5,430	46**	09/08(13)	0.325	1,316	905		
362E		55.6	18.9	5,100	203	09/30(16)	0.111	212	172		
395W		55.5	18.6	4,880	342*	10/19(23)	0.044	6.7	27.4		
418W		44.3	18.1	4,270	143	09/23(13)	0.157	5.9	4.2		
409W		51.1	18.3	4,490	29	09/01(03)	0.465	19.0	4.0		
359E	08/17	48.4	16.6	4,670	31*	09/01(10)	0.481	676	299		
357E	(08)	23.3	8.36	2,190	25	09/01(00)	0.490	116	50.8		
		36.6	14.8	3,510	187	09/28(21)	0.127	54.5	58.6		
300E		17.1	6.83	1,010	205	09/30(17)	0.117	201	502		
		23.8	9.58	2,590	32	09/01(10)	0.481	783	342		
		11.4	5.15	1,190	188	09/28(23)	0.127	158	546		
421W		52.7	20.5	6,020	196	09/30(13)	0.117	270	219		
422W		18.0	6.17	1,540	144	09/23(13)	0.165	5.0	8.4		
		15.8	6.04	1,610	237	10/06(20)	0.087	2.6	9.5		
380W		38.1	15.4	4,330	189	09/28(24)	0.127	113	117		
		23.1	9.71	2,560	60*	09/08(16)	0.336	77.2	99.4		
365E	08/18	30.8	11.3	2,770	209	09/30(18)	0.122	519	691		
361E	(08)	58.3	22.1	5,930	214	09/30(19)	0.122	1,680	1,181		
385E		57.3	23.9	5,750	210	09/30(18)	0.122	787	563		
373W		51.5	19.2	5,190	211	09/30(18)	0.122	488	388		
424W		43.8	17.8	4,250	207	09/30(17)	0.122	239	224		
398W		23.8	8.60	2,030	212	09/30(19)	0.122	314	541		
307E	08/24	53.7	20.3	5,600	181	09/24(14)	0.220	10,530	4,460		
449E	(08)	65.8	24.2	6,380	217	09/30(20)	0.162	1,848	867		
276E		34.9	15.1	3,460	190	09/30(12)	0.165	4,303	3,310		
372W		60.2	23.7	5,770	215	09/30(19)	0.162	618	317		
401W		64.1	23.5	6,180	180	09/24(14)	0.220	3,705	1,314		
416W		59.1	18.4	5,810	45*	09/18(13)	0.527	8,020	2,580		

Table 3 cont'd
P-32 Uptake in Catfish
Head

Fish No.	Date of death, 1982 (hr)	Weight, wet	dry	ashed	Sample No.	P-32 Date of counting, 1982 (hr)	decay fraction	net c/min.	c/min.g. wet	P, mg/ml	P-32/P, c/min.mg.
314E	8/26	56.1	20.1	4,920	332	10/15(12)	0.096	2,445	2,270		
369E	(08)	57.7	19.3	5,220	287	10/13(08)	0.097	3,818	3,400		
332E		52.0	18.5	4,740	448	11/03(13)	0.035	555	1,514		
448W		40.8	15.0	3,840	295	10/13(09)	0.097	551	695		
439W		80.6	26.8	6,530	543	11/07(12)	0.029	1,358	2,950		
389W		59.4	23.9	5,570	495	11/04(17)	0.033	780	1,969		
355E	9/01	72.6	24.9	6,440	626	11/17(15)	0.024	978	2,810		
393E	(08)	58.5	21.0	5,880	616	11/17(12)	0.024	410	1,460		
348E		44.1	16.7	4,340	499	11/04(18)	0.044	1,632	4,200		
414W		63.2	25.2	5,970	621	11/17(13)	0.024	399	1,315		
403W		37.9	14.4	4,070	623	11/17(05)	0.024	18.1	99.5		
404W		55.5	20.7	5,370	397	10/25(14)	0.072	2,342	2,930		
321E	9/10	54.0	18.2	5,510	243	10/07(19)	0.264	882	309		
363E	(08)	73.7	22.8	5,740	246	10/07(20)	0.264	4,181	1,074		
356E		20.3	6.53	1,930	223	09/30(21)	0.370	420	280		
387W		54.8	18.0	4,910	226	09/30(21)	0.370	7,634	1,883		
429W		51.8	16.1	5,300	242	10/07(19)	0.264	4,623	1,690		
431W		64.0	20.8	6,170	244	10/07(19)	0.264	1,713	507		
428W	9/23	71.0	23.6	6,210	294	10/13(09)	0.379	20,980	3,900		
410W	(08)	61.9	19.0	5,110	307	10/13(16)	0.374	8,604	1,858		
390W		55.0	18.9	5,190	304	10/13(12)	0.376	1,706	412		

Table 3 cont'd
P-32 Uptake in Catfish
Fin Spines

Fish No.	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32 Date of counting, 1982 (hr)	P-32 decay fraction	P-32 net c/min.	P-32 c/min.g. wet	P, mg/ml	P-32/P, c/min.mg.
351E	08/16	0.55	0.377	211	54	09/08(02)	0.330	53.0	1,460		
317E	(08)	0.68	0.424	227	48	09/08(13)	0.322	84.8	1,936		
362E		0.66	0.432	237	165	09/24(20)	0.147	11.1	572		
395W		0.59	0.411	232	140	09/23(15)	0.156	<2.2	<120		
418W		0.65	0.468	269	56	09/08(05)	0.330	<2.2	< 51		
409W		0.63	0.448	238	142	09/08(18)	0.322	<2.2	< 54		
359E	08/17	0.60	0.415	227	168	09/24(01)	0.161	17.4	901		
357E	(08)	0.80	0.522	281	186	09/28(20)	0.127	6.7	330		
300E		0.77	0.573	354	20	08/31(06)	0.510	75.9	966		
421W		0.81	0.603	338	167	09/24(23)	0.154	10.6	425		
422W		0.44	0.326	183	172	09/25(09)	0.151	<2.2	<170		
380W		0.62	0.478	272	40	09/02(24)	0.445	16.6	301		
365E	08/18	0.55	0.379	208	147	09/24(05)	0.166	38.8	2,120		
361E	(08)	0.81	0.589	321	176	09/25(16)	0.156	71.6	2,830		
385E		0.35	0.260	144	161	09/24(10)	0.166	20.5	1,764		
373W		0.84	0.603	333	146	09/23(24)	0.169	20.9	736		
424W		0.51	0.369	211	175	09/25(14)	0.156	12.0	754		
398W		0.29	0.210	118	194	09/29(03)	0.132	12.7	1,659		
307E	08/24	0.64	0.428	228	137	09/21(10)	0.254	619	19,040		
449E	(08)	0.75	0.563	318	139	09/23(13)	0.231	87.5	2,520		
276E		0.49(5)	0.837	672	154	09/21(13)	0.255	232			
372W		0.74	0.550	310	149	09/24(07)	0.222	23.5	715		
401W		0.80	0.605	342	151	09/21(12)	0.254	92.0	2,260		
416W		0.64	0.491	272	136	09/21(10)	0.254	306	9,410		

Table 3 cont'd
P-32 Uptake in Catfish
Fin Spines

Fish No.	Date of death, 1982 (hr)	Weight, wet	dry	ashed	Sample No.	P-32 Date of counting, 1982 (hr)	decay fraction	net c/min.	c/min.g. wet	P, mg/ml	P-32/P, c/min.mg.
314E	8/26	0.62	0.443	257	612	11/16(24)	0.018	11.2	4,990		
369E	(08)	0.64	0.445	251	317	10/14(03)	0.094	109	9,030		
332E		0.61	0.426	241	512	11/05(24)	0.031	14.2	3,710		
448W		0.58	0.421	237	658	11/22(21)	0.013	2.5	1,615		
439W		1.10	0.732	408	628	11/17(07)	0.018	19.1	4,800		
389W		0.72	0.532	308	480	11/04(02)	0.034	17.1	3,460		
355E	9/01	0.71	0.509	277	386	10/21(02)	0.089	98.5	7,790		
393E	(08)	1.12(5)	0.460	269	642	11/18(02)	0.023	4.6	893		
348E		0.68	0.424	253	667	11/23(22)	0.017	22.8	9,860		
414W		0.75	0.558	311	400	10/21(08)	0.089	29.6	2,220		
403W		0.48	0.408	239	666	11/23(20)	0.017	<2.2	<1,400		
404W		0.43	0.315	179	544	11/07(14)	0.038	24.6	7,530		
321E	9/10	0.59	0.357	219	268	10/07(10)	0.269	39.8	1,254		
363E	(08)	0.89	0.511	305	232	09/30(02)	0.383	187	2,740		
356E		0.30	0.213	134	248	10/07(04)	0.273	10.1	617		
387W		0.52	0.343	216	352	10/21(08)	0.137	92.1	6,460		
429W		0.46	0.332	212	240	10/07(18)	0.265	163	6,690		
431W		0.79	0.528	331	239	10/06(21)	0.277	53.8	1,229		
428W	9/23	0.63	0.376	225	351	10/20(05)	0.272	382	11,150		
410W	(08)	0.21	0.109	62.6	345	10/20(02)	0.273	47.2	4,120		
390W		0.55	0.311	191	340	10/19(19)	0.277	76.7	2,520		

Table 4
Catfish Food

Date of feeding, 1982	Vial No.	Dry wt, g	Amt. fed, g E	Amt. fed, g W	No. of fish E	No. of fish W	P-32 counting date, 1982	P-32 Decay factor	P-32 net c/min	P-32 c/min.g
08/15	438	0.98	238.2	151.2	69	69	10/26(02)	0.031	629	103,500
16			47.8	33.5	65	64				
17			89.0	34.2	62	60				
18	423	0.94	78.7	50.7	59	55	10/25(21)	0.036	672	99,300
19			77.9	115.2	59	55				
20			26	18.1	58	54				
21	430	0.96	156	81	58	50	10/25(23)	0.042	741	91,900
22			148	100	58	50				
23			86	40	55	50				
24			129	65	52	47				
25	436	1.02	142	119	52	47	10/26(01)	0.050	937	91,900
26			20	20	9	15				
27	431	1.03	20	20	6	12	10/25(24)	0.055	1,070	94,400
28			14.7	13.2	6	12				
29			4.9	4.6	6	12				
30	429	1.04	7.0	9.2	6	12	10/25(23)	0.065	1,238	91,600
	434	1.05					10/26(01)	0.065	1,203	88,100
31			1.3	2.3	6	12				
09/01			8.8	3.4	3	9				
02	425	0.98	4.3	10.0	3	9	10/25(22)	0.071	659	47,400
03			6.6	9.3	3	9				
04			4.8	15.0	3	9				
05	427	1.01	4.2	8.6	3	9	10/25(22)	0.082	801	48,400
06			2.1	8.8	3	9				
07			3.1	8.8	3	9				
08	421	1.00	2.9	15.0	3	9	10/25(20)	0.095	904	47,600
09			3.3	9.6	3	9				
10			---	1.2	0	6				
11	424	0.98	---	3.5	0	6	10/25(21)	0.110	1,119	51,900
12			---	3.0	0	6				
13					0	6				
14	422	0.98	---	12.0	0	6	10/25(21)	0.127	1,209	48,600
	428	1.01					10/25(23)	0.127	1,158	45,100

Table 4 cont'd
Catfish Food

Date of feeding, 1982	Vial No.	Dry wt, g	Amt. fed, g E	Amt. fed, g W	No. of fish E	No. of fish W	P-32 counting date, 1982	P-32 Decay factor	P-32 net c/min	P-32 c/min g
09/15				5.2	0	6				
16				5.3	0	6				
17	426	1.00	---	9.9	0	6	10/25(22)	0.147	1,337	45,500
18				8.3	0	6				
19				10.6	0	6				
20				9.	0	6				
21	435	1.02	---	3.1	0	6	10/26(01)	0.177	1,543	42,700
22					0	6				
23				1.2	0	3				

Notes: 1. 20-ml aliquots of 100-ml samples were counted.
2. Amount fed was based on estimated fish weight, as 2.0% (E) or 1.0% (W) of body weight. Lesser amounts were fed if fish reduced their intake.

Table 5a

Catfish Wet Weight

Fish Number	Weight, g Start	Death
	08/09	08/16
351 E	175.0	179.7
317 E	220.0	240.7
362 E	207.0	209.4
395 W	193.0	186.8
418 W	186.0	179.0
409 W	258.0	231.9
		08/17
359 E	199.0	
357 E	244.0	236.5
300 E	227.5	225.5
421 W	226.0	
422 W	163.0	155.0
380 W	236.0	235.5
		08/18
365 E	146.0	142.3
361 E	261.0	265.6
385 E	226.5	232.7
373 W	191.0	193.8
424 W	193.5	193.3
398 W	107.0	104.0
		08/24
307 E	201.0	237.8
449 E	284.0	260.7
276 E	157.0	165.1
372 W	261.0	261.4
401 W	223.0	244.9
416 W	211.0	234.1

Table 5a cont'd

Catfish Wet Weight

Fish Number	Weight, g Start	Death
	08/09	08/26
314 E	208.0	250.0
369 E	196.0	250.0
332 E	202.0	224.0
448 W	179.0	173.0
439 W	267.0	325.0
389 W	241.5	270.0
		09/01
355 E	243.0	260.7
393 E	189.0	208.6
348 E	156.0	181.0
414 W	254.0	256.3
403 W	145.5	134.4
404 W	227.5	226.7
		09/10
321 E	200.0	205.8
363 E	216.0	258.5
356 E	78.0	70.6
387 W	201.0	229.7
429 W	182.0	193.3
431 W	205.0	
		09/23
428 W	234.0	297.2
410 W	185.5	223.7
390 W	225.0	225.0

Table 5b

Bluegill Wet Weight

Fish No.	Weight, g			
	9/03	10/01	11/12	Death Date
				09/28
761 E	118.0			114.5
794 E	130.0			119.6
879 E	151.0			153.3
499 W	121.0			121.6
708 W	111.0			123.6
787 W	142.5			149.4
				09/29
684 E	159.0			156.5
859 E	133.5			139.8
863 E	95.0			93.6
608 W	102.5			107.9
682 W	137.0			148.7
890 W	126.0			139.7
				09/30
619 E	106.5			122.4
872 E	152.0			153.5
635 E	135.0			142.5
706 W	131.0			133.8
704 W	121.5			119.2
480 W	150.6			158.5
				10/06
759 E	113.5	103.9		98.6
674 E	95.0	101.1		102.4
762 E	122.5	119.8		114.0
613 W	96.0	102.7		103.5
680 W	80.5	84.5		82.4
792 W	105.0	114.4		109.2
				10/12
669 E	143.0	142.8		147.2
784 E	138.9	153.1		148.3
733 E		109.4		107.6
488 W	110.9	115.3		118.5
490 W	85.6	93.3		98.5
476 W	153.5	163.1		164.9

Table 5b cont'd

Bluegill Wet Weight

Fish No.	Weight, g			
	9/03	10/01	11/12	Death Date
				10/19
769 E	94.0	101.0		101.4
482 E	94.6	92.0		92.9
677 E	119.0	105.2		116.1
497 W	81.0	83.4		86.9
873 W	132.0	149.5		161.4
607 W	164.0	159.3		172.4
				10/26
876 E	93.0	99.5		105.0
763 E	129.0	132.8		140.5
881 E	89.5	88.1		85.9
785 W	130.5	135.5		147.6
716 W		135.7		148.6
875 W	145.0	153.5		158.2
				11/03
882 E	119.0	111.2		117.0
456 E	89.5	91.4		91.5
627 E	130.0	141.8		151.1
858 E	149.0	148.2		149.7
722 E	125.0	124.1		126.4
884 W	106.0	117.0		116.7
672 W	121.0	118.1		119.7
679 W	140.0	148.6		154.7
				11/09
799 E	122.0	118.5		124.1
790 E	120.5	135.7		132.6
486 E	146.0	134.4		132.6
602 W	134.5	136.6		135.0
893 W	119.0	109.1		118.0
798 W	150.5	161.7		169.2
				11/17
899 E	118.0	117.3	120.2	120.8
713 E	93.0	94.0	94.5	96.9
880 E	129.0	120.1	120.5	118.8
886 W	124.0	135.6	155.2	162.7
622 W	118.5	126.9	139.9	145.0
698 W	135.0	139.1	144.7	146.9

Table 5b cont'd

Bluegill Wet Weight

Fish No.	Weight, g 9/03	10/01	11/12	Death Date
				11/20
782 E	142.0	155.0	160.6	160.0
767 E	159.0	166.0	172.4	171.3
728 E		149.0	164.6	162.7
715 W		151.7	164.2	166.0
889 W	104.5	154.5	169.8	169.5
606 W	153.5	175.4	196.5	196.5
				11/24
477 E	135.0	140.7	148.9	147.0
738 E	114.0	111.0	115.3	115.7
691 E	140.0	155.0	161.5	160.7
668 W	131.0	150.3	161.2	161.1
717 W		108.9	117.8	118.3
891 W	135.0	143.3	143.2	143.3
				11/30
637 E	126.0	132.6	143.7	149.0
721 E		106.6	108.7	112.0
723 E		118.6	122.7	128.2
892 W	153.0	179.1	214.9	225.0
885 W	91.0	102.0	112.4	117.5
636 W	140.5	151.7	164.2	174.7
				12/07
730 E		117.6	123.2	125.6
871 E	112.5	121.9	122.2	122.8
705 E	155.5	148.5	143.7	148.4
641 W	96.0	96.4	102.4	109.2
615 W	128.0	146.6	156.1	154.1
735 W	98.0	95.5	105.0	113.2
				12/15
694 E	119.0	120.8	121.9	135.5
485 E	142.0	142.9	161.8	166.6
894 E	160.0	172.1	176.7	184.6
692 W	150.0	161.8	186.5	201.3
854 W	132.0	140.2	155.3	163.3
630 W	104.0	105.6	112.3	121.8

Table 6

P-32 in Water During Bluegill Uptake and Depuration Study

Collection date, 1982 (hr)	Sample	Vial No.	P-32 Counting date, 1982-1983 (hr)	Decay fraction	net c/min	c/min. L
11/09 (08)	E - 1 water*	1106	01/14(22)	0.040	2.2	68.8
	1 filter*	1146	01/22(09)	0.028	<2.2	<98
	W - 1 water*	1105	01/14(14)	0.040	16.9	264
	1 filter*	1147	01/22(11)	0.028	<2.2	<98
11/20 (08)	E - 1 water	957	02/01(21)	0.028	27.5	614
	1 filter	1181	02/03(19)	0.027	<2.2	<50
	2 water no filtration	958	12/24(02)	0.195	81.2	260
	W - 1 water	955	02/01(18)	0.028	137	3,060
	1 filter	1180	02/03(17)	0.027	5.0	116
	2 water	956	02/01(19)	0.028	30.5	681
	2 filter	1182	02/03(20)	0.027	<2.2	<51
	Inflow	1162	02/02(04)	0.028	<2.2	<49
11/24 (08)	E - 1 water	1133	01/21(12)	0.060	6.2	65
	1 filter	Lost				
	2 water	1110	01/19(18)	0.065	<2.2	<21
	2 filter	1151	01/22(18)	0.056	<2.2	<25
	W - 1 water	1109	01/15(03)	0.081	15.5	120
	1 filter	1150	01/22(16)	0.056	3.6	40.2
	2 water	1108	01/15(01)	0.081	17.0	131
	2 filter	1149	01/22(14)	0.056	<2.2	<25
	Inflow	1164	02/02(09)	0.034	<2.2	<40

Notes: 1. Four-liter samples were taken from 24-L aquaria (41.5-L on 11/09) and processed to 50-ml volumes. These were filtered and the filters were processed to 50-ml volumes
2. one asterisk indicates that only a 2-L sample was collected
3. two asterisks indicate approximately 15% loss during processing, for which the result was corrected

Table 6 cont'd

P-32 in Water During Bluegill Uptake and Depuration Study

			P-32			
Collection date, 1982 (hr)	Sample	Vial No.	Counting date, 1982-1983 (hr)	Decay fraction	net c/min	c/min. L
11/30 (08)	E - 1 water	1152	01/22(19)	0.075	4.2	35.0
	1 filter	1183	02/03(22)	0.042	<2.2	<33.
	2 water	1153	01/22(21)	0.075	3.3	27.5
	2 filter	1184	02/03(24)	0.042	<2.2	<33.
	W - 1 water	1107	01/24(24)	0.067	65.3	609
	1 filter	1148	01/22(13)	0.076	6.0	49.3
	2 water	1157	01/28(17)	0.056	53.2	594
	2 filter	1188	02/04(06)	0.041	3.2	48.8
12/07 (08)	E - 1 water	1155	01/28(14)	0.079	<2.2	<17
	1 filter	1186	02/04(03)	0.058	<2.2	<24
	2 water	1156	01/28(16)	0.079	<2.2	<17
	2 filter	1187	02/04(05)	0.058	<2.2	<24
	W - 1 water	1158	01/28(19)	0.079	6.4	50.6
	1 filter	1189	02/04(10)	0.057	<2.2	<24
	2 water	1154	02/01(23)	0.064	4.3	42.0
	2 filter	1185	02/04(02)	0.058	<2.2	<24
12/15 (08)	E - 1 water	1161	02/02(02)	0.094	<2.2	<15
	1 filter	1192	02/04(15)	0.084	<2.2	<16
	2 water	1163	02/02(05)	0.094	<2.2	<15
	2 filter	1216	02/08(22)	0.068	<2.2	<20
	W - 1 water	1159	01/28(21)	0.115	<2.2	<12
	1 filter	1190	02/04(12)	0.084	<2.2	<16
	2 water**	1160	02/01(24)	0.094	<2.2	<17
	2 filter	1191	02/04(13)	0.084	<2.2	<16

Table 7

P-32 in Suspended Solids During Bluegill Uptake and Depuration Study

			P-32			
Collection date, 1982 (hr)	Sample	Vial No.	Counting date, 1982-1983 (hr)	Decay fraction	net c/min	c/min. L
11/09	E-large	945	12/23(16)	0.125	12.0	1.4
	E-250μ	944	12/22(06)	0.127	21.7	2.6
	E-75μ	811	12/11(05)	0.217	66.5	8.0
	E-0.45μ (4)	1042	01/07(20)	0.057	<2.2	<380
		808	12/10(04)	0.228	<2.2	<100
		814	12/11(08)	0.216	2.4	110
		809	12/10(06)	0.228	<2.2	<100
	W-large	810	12/11(03)	0.218	5.4	0.65
	W-250μ	1008	12/31(10)	0.082	9.6	1.2
	W-75μ	922	12/21(15)	0.131	39.3	4.7
	W-0.45μ (4)	923	12/21(17)	0.131	<2.2	<170
		940	12/22(03)	0.128	<2.2	<170
		924	12/21(18)	0.130	<2.2	<170
		941	12/22(04)	0.128	<2.2	<170
11/20	E	1167	02/02(14)	0.027	3.9	30
	W	1172	02/02(22)	0.027	<2.2	<17
11/24	E	1174	02/03(02)	0.032	<2.2	<14
	W	1168	02/02(16)	0.033	<2.2	<14
11/30	E	1169	02/02(17)	0.046	<2.2	<10
	W	1171	02/02(20)	0.046	<2.2	<10
12/07	E	1173	02/02(24)	0.061	<2.2	<8
	W	1170	02/02(19)	0.062	<2.2	<8
12/15	E	1166	02/02(12)	0.093	<2.2	<5
	W	1165	02/02(10)	0.093	<2.2	<5

Notes: 1. For 11/09 samples, water volume was 41.5 L but only 0.50 L was passed through each 0.45-μ filter; samples were made up to 100 ml

2. For all other samples, water volume was 24 L and samples were made up to 100 ml

3. Large solids were collected on 11/09 with a small net; solids were collected on all other dates by siphoning them from the aquarium bottom and retaining them on a 75-μ filter

Table 8
Non-food Uptake of 32-P

Fish No.(1)	Date of death,(2) 1982 (hr)	Weight, (3) wet	dry	ashed	Sample No.	P-32 Date of counting, 1982 (hr)	decay fraction	net c/min	c/min.g. wet	P, mg/ml	P-32/P, c/min.mg.
						Bluegill Muscle					
683 B	12/10	57.7	11.2	714	927	12/21(20)	0.577	174	26.1		
857 B	(12)	70.4	14.2	854	926	12/22(09)	0.562	196	24.8		
626 U		40.8	7.94	529	965	12/23(07)	0.537	33.5	7.6		
628 U		22.1	4.44	298	917	12/19(10)	0.649	26.3	9.2		
638 U		11.8	2.34	154	967	12/23(08)	0.537	22.0	17.4		
878 U		38.5	7.59	509	920	12/19(14)	0.644	68.9	13.9		
						Catfish Muscle					
210.1 B	12/17	61.4	14.0	725	1087	01/13(04)(4)	0.274	74.3	22.1		
160.4 B	(11)	51.0	11.9	591	1072	01/12(08)	0.285	86.4	29.7		
150.7 B		49.6	11.4	---	Lost	---	---	---	---		
137.0 U		33.7	9.62	485	1086	01/13(01)	0.275	27.6	18.2		
117.4 U		35.8	8.09	413	1064	01/11(20)	0.292	26.8	12.8		
128.0 U		38.3	8.90	436	1079	01/12(17)	0.280	37.1	17.3		

Notes: (1) B: blocked esophagus; U: unblocked
(2) Bluegill exposure began on 12/6 (1700) except for #857 and 878 which were exposed from 12/8(11) to 12/12(11); catfish exposure began on 12/13(1100).
(3) Wet and dry weight in gram; ashed weight in mg.
(4) Month 01 is in 1983 .

Table 5b cont'd

Bluegill Wet Weight

Fish No.	Weight, g 9/03	10/01	11/12	Death Date
				10/19
769 E	94.0	101.0		101.4
482 E	94.6	92.0		92.9
677 E	119.0	105.2		116.1
497 W	81.0	83.4		86.9
873 W	132.0	149.5		161.4
607 W	164.0	159.3		172.4
				10/26
876 E	93.0	99.5		105.0
763 E	129.0	132.8		140.5
881 E	89.5	88.1		85.9
785 W	130.5	135.5		147.6
716 W		135.7		148.6
875 W	145.0	153.5		158.2
				11/03
882 E	119.0	111.2		117.0
456 E	89.5	91.4		91.5
627 E	130.0	141.8		151.1
858 E	149.0	148.2		149.7
722 E	125.0	124.1		126.4
884 W	106.0	117.0		116.7
672 W	121.0	118.1		119.7
679 W	140.0	148.6		154.7
				11/09
799 E	122.0	118.5		124.1
790 E	120.5	135.7		132.6
486 E	146.0	134.4		132.6
602 W	134.5	136.6		135.0
893 W	119.0	109.1		118.0
798 W	150.5	161.7		169.2
				11/17
899 E	118.0	117.3	120.2	120.8
713 E	93.0	94.0	94.5	96.9
880 E	129.0	120.1	120.5	118.8
886 W	124.0	135.6	155.2	162.7
622 W	118.5	126.9	139.9	145.0
698 W	135.0	139.1	144.7	146.9

Table 5b cont'd

Bluegill Wet Weight

Fish No.	Weight, g 9/03	10/01	11/12	Death Date
				11/20
782 E	142.0	155.0	160.6	160.0
767 E	159.0	166.0	172.4	171.3
728 E		149.0	164.6	162.7
715 W		151.7	164.2	166.0
889 W	104.5	154.5	169.8	169.5
606 W	153.5	175.4	196.5	196.5
				11/24
477 E	135.0	140.7	148.9	147.0
738 E	114.0	111.0	115.3	115.7
691 E	140.0	155.0	161.5	160.7
668 W	131.0	150.3	161.2	161.1
717 W		108.9	117.8	118.3
891 W	135.0	143.3	143.2	143.3
				11/30
637 E	126.0	132.6	143.7	149.0
721 E		106.6	108.7	112.0
723 E		118.6	122.7	128.2
892 W	153.0	179.1	214.9	225.0
885 W	91.0	102.0	112.4	117.5
636 W	140.5	151.7	164.2	174.7
				12/07
730 E		117.6	123.2	125.6
871 E	112.5	121.9	122.2	122.8
705 E	155.5	148.5	143.7	148.4
641 W	96.0	96.4	102.4	109.2
615 W	128.0	146.6	156.1	154.1
735 W	98.0	95.5	105.0	113.2
				12/15
694 E	119.0	120.8	121.9	135.5
485 E	142.0	142.9	161.8	166.6
894 E	160.0	172.1	176.7	184.6
692 W	150.0	161.8	186.5	201.3
854 W	132.0	140.2	155.3	163.3
630 W	104.0	105.6	112.3	121.8

Table 6

P-32 in Water During Bluegill Uptake and Depuration Study

			P-32			
Collection date, 1982 (hr)	Sample	Vial No.	Counting date, 1982-1983 (hr)	Decay fraction	net c/min	c/min. L
11/09 (08)	E - 1 water*	1106	01/14(22)	0.040	2.2	68.8
	1 filter*	1146	01/22(09)	0.028	<2.2	<98
	W - 1 water*	1105	01/14(14)	0.040	16.9	264
	1 filter*	1147	01/22(11)	0.028	<2.2	<98
11/20 (08)	E - 1 water	957	02/01(21)	0.028	27.5	614
	1 filter	1181	02/03(19)	0.027	<2.2	<50
	2 water no filtration	958	12/24(02)	0.195	81.2	260
	W - 1 water	955	02/01(18)	0.028	137	3,060
	1 filter	1180	02/03(17)	0.027	5.0	116
	2 water	956	02/01(19)	0.028	30.5	681
	2 filter	1182	02/03(20)	0.027	<2.2	<51
	Inflow	1162	02/02(04)	0.028	<2.2	<49
11/24 (08)	E - 1 water	1133	01/21(12)	0.060	6.2	65
	1 filter	Lost				
	2 water	1110	01/19(18)	0.065	<2.2	<21
	2 filter	1151	01/22(18)	0.056	<2.2	<25
	W - 1 water	1109	01/15(03)	0.081	15.5	120
	1 filter	1150	01/22(16)	0.056	3.6	40.2
	2 water	1108	01/15(01)	0.081	17.0	131
	2 filter	1149	01/22(14)	0.056	<2.2	<25
	Inflow	1164	02/02(09)	0.034	<2.2	<40

Notes: 1. Four-liter samples were taken from 24-L aquaria (41.5-L on 11/09) and processed to 50-ml volumes. These were filtered and the filters were processed to 50-ml volumes
2. one asterisk indicates that only a 2-L sample was collected
3. two asterisks indicate approximately 15% loss during processing, for which the result was corrected

Table 6 cont'd

P-32 in Water During Bluegill Uptake and Depuration Study

Collection date, 1982 (hr)	Sample	Vial No.	Counting date, 1982-1983 (hr)	P-32 Decay fraction	net c/min	c/min. L
11/30 (08)	E - 1 water	1152	01/22(19)	0.075	4.2	35.0
	1 filter	1183	02/03(22)	0.042	<2.2	<33.
	2 water	1153	01/22(21)	0.075	3.3	27.5
	2 filter	1184	02/03(24)	0.042	<2.2	<33.
	W - 1 water	1107	01/24(24)	0.067	65.3	609
	1 filter	1148	01/22(13)	0.076	6.0	49.3
	2 water	1157	01/28(17)	0.056	53.2	594
	2 filter	1188	02/04(06)	0.041	3.2	48.8
12/07 (08)	E - 1 water	1155	01/28(14)	0.079	<2.2	<17
	1 filter	1186	02/04(03)	0.058	<2.2	<24
	2 water	1156	01/28(16)	0.079	<2.2	<17
	2 filter	1187	02/04(05)	0.058	<2.2	<24
	W - 1 water	1158	01/28(19)	0.079	6.4	50.6
	1 filter	1189	02/04(10)	0.057	<2.2	<24
	2 water	1154	02/01(23)	0.064	4.3	42.0
	2 filter	1185	02/04(02)	0.058	<2.2	<24
12/15 (08)	E - 1 water	1161	02/02(02)	0.094	<2.2	<15
	1 filter	1192	02/04(15)	0.084	<2.2	<16
	2 water	1163	02/02(05)	0.094	<2.2	<15
	2 filter	1216	02/08(22)	0.068	<2.2	<20
	W - 1 water	1159	01/28(21)	0.115	<2.2	<12
	1 filter	1190	02/04(12)	0.084	<2.2	<16
	2 water**	1160	02/01(24)	0.094	<2.2	<17
	2 filter	1191	02/04(13)	0.084	<2.2	<16

Table 7

P-32 in Suspended Solids During Bluegill Uptake and Depuration Study

Collection date, 1982 (hr)	Sample	Vial No.	P-32 Counting date, 1982-1983 (hr)	Decay fraction	net c/min	c/min. L
11/09	E-large	945	12/23(16)	0.125	12.0	1.4
	E-250μ	944	12/22(06)	0.127	21.7	2.6
	E-75μ	811	12/11(05)	0.217	66.5	8.0
	E-0.45μ (4)	1042	01/07(20)	0.057	<2.2	<380
		808	12/10(04)	0.228	<2.2	<100
		814	12/11(08)	0.216	2.4	110
		809	12/10(06)	0.228	<2.2	<100
	W-large	810	12/11(03)	0.218	5.4	0.65
	W-250μ	1008	12/31(10)	0.082	9.6	1.2
	W-75μ	922	12/21(15)	0.131	39.3	4.7
	W-0.45μ (4)	923	12/21(17)	0.131	<2.2	<170
		940	12/22(03)	0.128	<2.2	<170
		924	12/21(18)	0.130	<2.2	<170
		941	12/22(04)	0.128	<2.2	<170
11/20	E	1167	02/02(14)	0.027	3.9	30
	W	1172	02/02(22)	0.027	<2.2	<17
11/24	E	1174	02/03(02)	0.032	<2.2	<14
	W	1168	02/02(16)	0.033	<2.2	<14
11/30	E	1169	02/02(17)	0.046	<2.2	<10
	W	1171	02/02(20)	0.046	<2.2	<10
12/07	E	1173	02/02(24)	0.061	<2.2	<8
	W	1170	02/02(19)	0.062	<2.2	<8
12/15	E	1166	02/02(12)	0.093	<2.2	<5
	W	1165	02/02(10)	0.093	<2.2	<5

Notes: 1. For 11/09 samples, water volume was 41.5 L but only 0.50 L was passed through each 0.45-μ filter; samples were made up to 100 ml
2. For all other samples, water volume was 24 L and samples were made up to 100 ml
3. Large solids were collected on 11/09 with a small net; solids were collected on all other dates by siphoning them from the aquarium bottom and retaining them on a 75-μ filter

Table 8
Non-food Uptake of 32-P

Fish No.(1)	Date of death,(2) 1982 (hr)	Weight, (3) wet	dry	ashed	Sample No.	P-32 Date of counting, 1982 (hr)	decay fraction	net c/min	c/min.g. wet	P, mg/ml	P-32/P, c/min.mg.
						Bluegill Muscle					
683 B	12/10	57.7	11.2	714	927	12/21(20)	0.577	174	26.1		
857 B	(12)	70.4	14.2	854	926	12/22(09)	0.562	196	24.8		
626 U		40.8	7.94	529	965	12/23(07)	0.537	33.5	7.6		
628 U		22.1	4.44	298	917	12/19(10)	0.649	26.3	9.2		
638 U		11.8	2.34	154	967	12/23(08)	0.537	22.0	17.4		
878 U		38.5	7.59	509	920	12/19(14)	0.644	68.9	13.9		
						Catfish Muscle					
210.1 B	12/17	61.4	14.0	725	1087	01/13(04)(4)	0.274	74.3	22.1		
160.4 B	(11)	51.0	11.9	591	1072	01/12(08)	0.285	86.4	29.7		
150.7 B		49.6	11.4	---	Lost	---	---	---	---		
137.0 U		33.7	9.62	485	1086	01/13(01)	0.275	27.6	18.2		
117.4 U		35.8	8.09	413	1064	01/11(20)	0.292	26.8	12.8		
128.0 U		38.3	8.90	436	1079	01/12(17)	0.280	37.1	17.3		

Notes: (1) B: blocked esophagus; U: unblocked
(2) Bluegill exposure began on 12/6 (1700) except for #857 and 878 which were exposed from 12/8(11) to 12/12(11); catfish exposure began on 12/13(1100).
(3) Wet and dry weight in gram; ashed weight in mg.
(4) Month 01 is in 1983 .

Table 8 cont'd
Non-food Uptake of 32-P

Fish No.(1)	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32 Date of counting, 1982 (hr)	P-32 decay fraction	P-32 net c/m	P-32 c/min.g. wet	P, mg/ml	P-32/P, c/min.mg.
						Bluegill Skeleton					
683 B	12/10	58.7	16.4	5,104	968	12/23(10)	0.534	535.	85.3		
857 B	(12)	45.7	14.9	4,557	1094	01/14(16)	0.200	188.	103.		
626 U		41.4	12.1	4,360	1049	01/11(06)	0.214	53.7	30.3		
628 U		20.9	4.09	1,317	1051	01/11(08)	0.214	22.0	24.6		
638 U		8.1	2.37	753	976	12/24(15)	0.504	67.6	82.8		
878 U		44.2	13.2	4,674	1055	01/11(13)	0.212	89.9	48.0		
						Catfish Skeleton					
210.1 B	12/17	31.0	10.8	1,940	1084	01/12(23)	0.277	82.7	48.2		
160.4 B	(11)	24.8	8.32	948	1071	01/12(06)	0.286	97.6	68.8		
150.7 B		22.4	7.65	878	1044	01/11(23)	0.291	61.4	47.1		
137.0 U		33.7	7.02	807	1095	01/13(20)	0.265	19.7	11.0		
117.4 U		20.0	6.43	770	1063	01/11(18)	0.293	21.2	18.1		
128.0 U		21.0	7.05	872	1067	01/12(01)	0.289	32.0	26.4		

Table 8 cont'd
Non-food Uptake of 32-P

Fish No.(1)	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32: Date of counting, 1982 (hr)	P-32: decay fraction	P-32: net c/m	P-32: c/min.g. wet	P, mg/ml	P-32/P, c/min.mg.
					Bluegill Skin						
683 B	12/10	31.3	13.2	5,928	977	12/24(17)	0.502	536.	171.		
857 B	(12)	23.7	9.77	4,125	1050	01/07(16)	0.255	212.	175.		
626 U		23.5	9.65	4,323	978	12/24(18)	0.501	80.6	34.2		
628 U		6.2	2.27	693	1085	01/13(01)	0.217	11.5	42.7		
638 U		4.9	1.51	373	975	12/24(14)	0.505	47.2	95.4		
878 U		24.2	10.0	4,325	1056	01/11(15)	0.211	82.0	80.3		
					Catfish Skin						
210.1 B	12/17	17.6	5.59	149	1092	01/13(06)	0.273	26.6	27.7		
160.4 B	(11)	12.2	3.73	92.9	1062	01/11(17)	0.294	25.8	36.0		
150.7 B		8.8	2.58	53.9	1048	01/11(04)	0.302	14.5	27.3		
137.0 U		11.7	3.92	108	1093	01/13(18)	0.266	5.8	9.3		
117.4 U		11.4	3.18	91.1	1066	01/11(23)	0.291	6.8	10.2		
128.0 U		13.3	4.57	98.1	1065	01/11(22)	0.291	11.8	15.2		

Table 8 cont'd
Non-food Uptake of 32-P

Fish No.(1)	Date of death, 1982 (hr)	Weight, wet	dry	ashed	Sample No.	P-32 Date of counting, 1982 (hr)	decay fraction	net c/m	c/min.g. wet	P, mg/ml	P-32/P, c/min.mg.
						Bluegill Head					
683 B	12/10	78.2	21.7	7,137	928	12/22(10)	0.561	563.	64.2		
857 B	(12)	65.9	20.1	5,912	1057	01/07(13)	0.257	268.	79.1		
626 U		69.9	19.3	6,733	929	12/21(22)	0.575	94.4	11.7		
628 U		21.5	5.60	1,489	1046	01/11(01)	0.217	28.6	30.7		
638 U		13.6	3.54	972	930	12/21(23)	0.575	122.	78.0		
878 U		64.7	18.2	6,176	980	12/24(20)	0.499	163.	25.2		
						Catfish Head					
210.1 B	12/17	61.6	18.7	5,170	1103	01/14(10)	0.258	181.	56.9		
160.4 B	(11)	42.2	12.5	2,484	1074	01/07(14)	0.358	275.	91.0		
150.7 B		38.5	12.1	2,307	1061	01/07(14)	0.358	206.	74.7		
137.0 U		36.7	11.6	2,159	1104	01/14(12)	0.245	34.5	19.2		
117.4 U		34.5	10.3	1,927	1075	01/12(12)	0.283	42.9	22.0		
128.0 U		36.5	12.1	2,437	1073	01/12(09)	0.285	80.0	38.5		

Table 8 cont'd
Non-food Uptake of 32-P

Fish No.(1)	Date of death, 1982 (hr)	Weight, wet	dry	ashed	Sample No.	P-32 Date of counting, 1982 (hr)	decay fraction	net c/m	c/min.g. wet	P, mg/ml	P-32/P, c/min.mg.
						Bluegill Viscera					
683 B	12/10	12.4	2.61	146.	971	12/23(11)	0.533	1,506	1,139		
857 B	(12)	11.2	2.90	91.5	973	12/23(12)	0.533	1,281	1,073		
626 U		8.1	1.44	92.0	986	12/23(13)	0.533	185	214		
628 U		2.2	0.376	23.8	969	12/24(10)	0.509	141	630		
638 U		1.8	0.318	19.8	974	12/23(12)	0.533	223	1,162		
878 U		8.1	1.56	93.7	1052	01/07(16)	0.255	215	520		
						Catfish Viscera					
210.1 B	12/17	15.1	3.29	134.	1100	01/14(05)	0.261	122.	155.		
160.4 B	(11)	14.4	4.64	115.	1069	01/07(16)	0.356	277.	270.		
150.7 B		15.3	5.87	103.	1047	01/11(02)	0.303	63.6	68.6		
137.0 U		12.8	5.94	86.8	1099	01/14(03)	0.262	44.1	65.8		
117.4 U		9.3	4.13	60.6	1076	01/12(14)	0.282	63.6	121.		
128.0 U		12.1	5.22	82.6	1077	01/07(15)	0.358	135.	156.		

Table 8 cont'd
Non-food Uptake of 32-P

Fish No.(1)	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32 Date of counting, 1982 (hr)	P-32 decay fraction	P-32 net c/m	P-32 c/min.g. wet	P, mg/ml	P-32/P, c/min.mg.
						Bluegill Gills					
683 B	12/10	1.38	0.201	15.1	985	12/25(03)	0.492	38.8	286		
857 B	(12)	1.09	0.168	12.9	914	12/19(06)	0.654	64.4	452		
626 U		1.04	0.154	12.8	970	12/24(12)	0.507	6.2	58.8		
628 U		0.21	0.036	2.6	915	12/19(07)?	0.653	3.0	109		
638 U		0.13	0.021	0.2	912	12/19(02)?	0.660	2.1	122		
878 U		0.92	0.138	8.3	913	12/19(04)?	0.657	17.7	146		
						Catfish Gills					
210.1 B	12/17	1.27	0.237	10.4	1082	01/12(20)	0.279	7.7	109		
160.4 B	(11)	0.75	0.137	4.9	1068	01/12(03)	0.288	5.4	125		
150.7 B		0.97	---	6.1	1053	01/11(10)	0.298	6.7	116		
137.0 U		1.05	0.207	7.7	1097	01/13(24)	0.263	<2.2	<40		
117.4 U		0.69	0.128	4.4	1078	01/12(15)	0.281	<2.2	<57		
128.0 U		0.49	0.133	5.6	1070	01/12(04)	0.288	<2.2	<78		

Table 9

P-32 Concentration in Water for Test of Non-food Uptake

Fish Sampling	Vial No.	Description	date counted	decay fraction	net c/min	c/min ml
Bluegill						
12/10	10	Initial	12/11(11)	0.955	6,633	347
(12)	11	Final T1	12/11(12)	0.953	6,659	349
	12	Final T2	12/11(14)	0.949	6,716	354
	13	Final T3	12/16(23)	0.806	5,145	319
	14	Final T4	12/16(24)	0.804	5,184	322
Catfish						
12/17	20	Initial	12/17(14)	0.994	7,198	362
(11)	21	Final T1	12/17(14)	0.994	7,332	369
	22	Final T2	12/17(15)	0.992	7,017	354
	23	Final T3	12/17(15)	0.992	6,979	352
	24	Final T4	12/17(15)	0.992	6,967	351

Note: Fish were 2 days in Tanks 1 or 2 and then 2 days in Tanks 3 or 4.

E-26-679

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MEMORANDUM

TO: Paul F. Hayes
Siting and Environmental Branch
Division of Health, Siting and Waste Management
Office of Nuclear Regulatory Research, USNRC

FROM: Bernd Kahn, Director
Environmental Resources Center

DATE: May 9, 1983

SUBJ: Bioaccumulation of P-32 in Fish
Quarterly Progress Report January 1 - March 31, 1983
(NRC No. 04-91-187, GT No. E-26-679)

The final experiment in the project was completed during this quarter. The effect of type of food, amount of food, and water temperature on the retention of P-32 in fish tissue for catfish and bluegill was observed. Sets of three fish in 20-gal aquaria were maintained for a 9-day period at several temperatures and fed P-32-spiked worms or pellets at several daily intake amounts. All P-32 measurements for this experiment and all earlier ones were completed. Measurement of stable phosphorus was begun for all samples collected in the study (see Tables 1 - 9 in the quarterly report for October-December, 1982, and Tables 10 - 14 of this report). A summary of activities was presented to U.S. NRC staff on March 3, 1983 in Bethesda, MD. Extension of the project to September 30, 1983, was requested to permit completion of stable phosphorus measurements, data analysis, and writing the final report.

In the first part of the final experiment, performed January 18 - 27, six sets of bluegill and two sets of catfish were maintained under the feeding and water temperature regime shown in Table 11a. The 9-day period was selected to be comparable to the interval between initiation and fourth sample collection in the large-tank study for bluegill (see Table 1, previous quarterly report). The feeding regimes of 1.5 g and 3.0 g worms per 100 g body weight at 20° C were the same in the large-tank study. The catfish in the large-tank experiment had been fed pellets -- 1.0 g or 2.0 g per 100 g body weight -- at approximately 25° C (see Table 3, previous quarterly report).

In the second part of the same experiment, performed February 8 - 17, six sets of catfish and two sets of bluegill were maintained under the feeding conditions and water temperatures shown in Table 11b. The first part of the experiment was repeated with catfish and bluegill essentially interchanged, for comparison with the large-tank study for catfish.

The P-32 tracer levels in the worms and pellets fed daily to the fish are given in Tables 12a and 12b. The 16 worm and 18 pellet samples have normally distributed values, with a mean and standard deviation of 19,100 ± 7,400 c/min.g wet weight for the worms and 300,000 ± 8,000 c/min.g wet weight for the pellets. The amounts of tracer added to the worm feed and pellets were 321,000 and 336,000 c/min.g wet weight of feed, respectively. The transfer of 5.9 percent from the worm feed to the worms is the same as the transfer observed for the worms fed to bluegill in the large-tank experiment (see previous quarterly report). The 89 percent transfer to pellets suggests a gain of moisture between feeding and sample measurement, because the tracer was added to feed that contained 10 percent more weight than indicated, due to moisture. The feed and P-32 tracer were mixed and then dried.

The fish weights and actual feeding rates for the experiment are given in Tables 13a and 13b. In most instances, the worm intake approximated the specified intake percent, but fish consumed only between one-third and one-half of the intended pellet intake specified in Tables 11b. Pellet intake rates were very low initially and only approached specified values during the two final days of the experiment, as shown in Table 12b. Most fish weights did not change considerably during the 9-day period of study. Changes ranged from a gain of 16 g to a loss of 28 g.

Concentrations of P-32 measured in the aquarium water are given in Tables 14a and 14b. Samples were collected on the 8th day of the experiment, just before the daily water change. The change was accomplished by siphoning approximately 55 liters of the 70 liters in each aquarium and adding 55 l fresh water. The water was obtained from Atlanta city water, passed through the same charcoal columns for chlorine removal as in the large-tank experiments. For worm-fed fish, the change was performed 1 - 2 hours before feeding; the fish were fed between 2:30 and 6:30 p.m. For pellet-fed fish, water was changed 3 - 5 hours before feeding; feeding was between 5 and 7 p.m.

The experiment indicates that P-32 concentrations averaged for all major tissues were generally higher at greater daily phosphorus (and P-32) ingestion rates and in warmer water. The ratio of tissue P-32 concentration relative to food was similar in the two species, but was relatively higher for worm than for pellet food. Differences among the three fish per aquarium were generally much greater than among fish in the large tanks. The effect of a 'pecking order' was immediately noticeable for bluegill (see Table 13), to the extent that the lowest fish of this order were prevented from feeding by more dominant fish . To eliminate this effect, a piece of perforated plastic was used with worm-fed bluegill temporarily placed in some of the tanks to protect the weakest fish.

Tissue weights are compared in Tables 15a, b, c, d, and e with total wet weights of fish just before dissection to indicate the extent of recovery. Summed tissue weights range from 86 to 104 percent; average values and standard deviations were 94 ± 2 percent both for 122 bluegill and 72 catfish. Differences are believed due to some uncertainty in measured wet weights as well as changes in wet weight, loss of liquid, and minor removals of solids during dissection. The wet weights of the fish in the non-feeding (P-32 in water) experiment are given in Table 10, which was omitted from the previous quarterly report.

The stable phosphorus data for fish muscle are presented in the final two columns of Tables 1, 3, and 8, as well as in the new Tables 11a and 11b. Measurements were performed according to Standard Methods for Water and Wastewater, 15th edition, 1980, pp. 415 - 417, using the vanadomolybdophosphoric acid colorimeteric method for phosphate. A Beckman DB-GT spectrophotometer was used to measure transmission at 470 nm. The solutions that were produced by ashing tissue and dissolving it in hydrochloric acid were used. These were the same samples that had been measured for P-32 levels. Phosphate was measured directly and then with standard added; the reported value is from the standard-addition technique. The results are consistent with the average concentration of 2 mg/g wet weight of muscle that had been recommended earlier.

A set of replicate phosphorus analyses of a muscle sample is given in Table 16 to indicate reproducibility of this procedure directly and by the standard addition technique. The standard deviation was 1 percent. Most concentrations determined by standard addition were within 10 percent of the direct measurements. Only a few samples showed larger differences.

The March 3 summary of available information presented uptake and depuration curves for sampled tissues in bluegill and catfish on the basis of P-32 per wet weight. For bluegill, depuration rates were consistent with a 14.3-day combined half life (radiological and biological) for muscle, skeleton, head, and skin, 10.7 days for gills, and 7.3 days for viscera. Uptake rate constants for gills and viscera appeared to be even more rapid. The tissue levels in bluegills fed 3.0 g worms per 100 g body weight were 1.3 - 1.4 times the levels of fish fed one-half this amount. For catfish, data from the initial 11 days of feeding were consistent with a 14.3-day half life in muscle and skeleton, and the fish fed twice the amount of pellets retained approximately twice the P-32 level in muscle and bone. Balances indicated that approximately 50 percent of the intake was retained by bluegill fed 1.5 g worms/100 g weight, and approximately 15 percent by catfish fed 1.0 g pellets/100 g weight. Radioactivity balances during depuration were consistent with relatively low levels in water, indicating a slow biological turnover (i.e., excretion) rate.

The next quarter is being devoted entirely to performing stable phosphorus analysis on all remaining samples, taking feed, water, and tissue in that order. It is anticipated that all measurements will be completed by June 30. Data analysis will then proceed on the basis of specific activity values.

The following students participated in this study during the quarter:

Name	Department	Fraction of time
David Martini, GRA	Biology	1/2
Susan Dunkerly, GRA	Biology	1/3
Robert Hammond, GRA	NE & HP	1/3
Ruben Uribe, SA	Biology	1/5

P-32 Uptake and Depuration in Bluegill
Muscle

Fish No.(1)	Date of death, 1982 (hr)	Weight,(2) wet	dry	ashed	Sample No.	P-32 Date of counting, 1982 (hr)	decay fraction	net c/min.(3)	c/min.g. wet	P, mg/g	P-32/P, c/min.mg.
761E	09/28	22.5	4.10	277	285	10/12(18)	0.498	33.0	14.7	2.31	6.36
794E	(08)	23.1	3.48	307	326	10/15(05)	0.441	10.6	5.2	2.43	2.14
879E		34.3	6.23	398	314	10/14(21)	0.447	22.5	7.3	2.31	3.16
499W		16.3	2.42	169	315	10/14(23)	0.447	120	82.3	1.93(7)	42.6
708W		30.7	5.53	403	334	10/19(10)	0.360	136	61.5	2.60	23.7
787W		29.1	5.75	347	325	10/14(12)	0.456	231	87.0	2.42	36.0
684E	09/29	42.3	7.74	470	452	11/02(18)	0.189	69.2	43.3	2.16(7)	20.0
859E	(08)	31.8	--	333	443	11/02(17)	0.189	137.	114	2.14(7)	53.3
863E		20.9	4.33	254	457	11/03(01)	0.186	54.4	70.0	2.27	30.8
608W		27.1	5.67	334	458	11/04(14)	0.173	183.	195	2.28	85.5
682W		39.1	7.47	424	444	11/03(11)	0.182	231.	162	2.16(7)	75.0
890W		33.8	6.50	394	571	11/09(13)	0.136	233	243	3.01	80.7
619E	09/30	37.3	6.54	401	503	11/05(19)	0.170	28.0	22.1	2.03	11.08
872E	(08)	39.2	7.52	474	420	10/25(20)	0.291	248	109	2.43	44.9
635E		38.0	7.46	468	433	10/26(01)	0.288	381	174	2.25	77.3
706W		29.2	5.38	347	451	11/03(14)	0.191	204	183	2.63	69.6
704W		32.4	6.61	405	454	11/03(14)	0.191	192	155	2.49	62.3
480W		45.9	9.80	610	415	10/25(18)	0.292	429	160	2.41	66.4
759E	10/06	24.3	3.85	118(6)	532	11/06(18)	0.218	259	244	1.86(7)	131
674E	(08)	20.1	4.05	266	584	11/09(15)	0.190	306	401	2.05	196
762E		28.6	5.94	339	459	11/03(15)	0.254	514	354	1.85	191
613W		33.4	7.25	417	460	11/03(15)	0.254	646	381	2.32	164
680W		22.2	4.73	256	466	11/04(11)	0.244	528	487	2.53	193
792W		32.1	7.12	396	549	11/07(22)	0.206	770	582	2.57	227
699E	10/12	29.9	5.31	357	597	11/10(12)	0.243	1,167	803	2.28	352
784E	(08)	35.7	6.88	455	494	11/04(17)	0.322	2,048	891	2.27	393
733E		21.0	3.59	228	475	11/04(14)	0.325	500	366	2.09	175
488W		34.2	6.90	398	518	11/04(22)	0.319	1,957	897	1.99	451
490W		23.0	4.72	302	586	11/09(16)	0.253	766	658	2.66(7)	247
476W		40.0	8.00	497	523	11/04(22)	0.319	948	371	2.45	151

(1) W fish received twice as much feed as E fish, at same specific activity (2) Wet and dry weight in gram; ashed weight in mg. (3) Duplicate 20-ml aliquots of 100-ml samples were analyzed for P-32 by Cherenkov counting with 50-min counts when < 200 c/min and 10-min counts when > 200 c/min (4) Tail samples were combined with skeleton samples after 10/19 (5) Month 01 is in 1983 (6) Weight appears to be erroneous (7) Average of 2 or more measurements

Table 1 cont'd
P-32 Uptake and Depuration in Bluegill
Muscle

Fish No.	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32 Date of counting, 1982 (hr)	P-32 decay fraction	P-32 net c/min	P-32 c/min.g. wet	P, mg/g	P-32/P, c/min.mg.
769E	10/19	28.4	6.01	351	613	11/17(11)	0.244	1,044	753	2.35	320
482E	(08)	25.4	5.38	301	617	11/17(13)	0.243	735	595	1.96	304
677E		21.9	2.79	198	556	11/08(08)	0.379	724	436	1.51	289
497W		23.4	4.96	287	555	11/08(08)	0.379	1,640	925	2.56	361
873W		40.2	8.35	416	624	11/17(14)	0.243	2,770	1,418	2.62	541
607W		39.8	8.00	478	627	11/17(15)	0.243	1,770	915	2.64	347
876E	10/26	29.4	5.67	332	673	11/23(13)	0.255	1,121	748	2.18	343
763E	(08)	26.8	5.33	331	654	11/23(11)	0.255	1,118	818	2.34	350
881E		23.6	5.07	300	695	11/24(06)	0.246	177	152	2.63	57.8
785W		33.2	7.05	422	651	11/23(10)	0.256	1,592	937	2.39	392
716W		33.3	7.23	427	647	11/18(14)	0.325	2,660	1,229	1.97	624
875W		40.4	8.90	528	646	11/18(14)	0.325	2,450	933	2.64	353
882E	11/03	22.8	4.37	268	703	11/24(22)	0.351	1,200	750	2.46	305
456E	(08)	24.1	5.20	298	701	11/24(18)	0.354	1,095	642	2.59	248
627E		34.7	6.97	448	795	12/10(11)	0.166	1,427	1,239	2.65	468
858E		38.4	7.86	471	698	11/24(16)	0.356	1,569	574	2.65	217
722E		36.4	7.68	434	702	11/24(20)	0.352	1,452	567	2.28	249
884W		34.5	7.21	435	705	11/25(01)	0.349	1,939	805	2.47	326
672W		25.0	4.53	301	670	11/23(12)	0.375	765	408	2.26	181
679W		34.3	6.51	430	685	11/24(13)	0.358	2,438	993	2.30	406
799E	11/09	28.2	5.51	374	717	11/25(21)	0.448	2,213	875	2.45	357
790E	(08)	41.3	8.91	539	719	11/26(01)	0.444	2,355	642	2.50	257
486E		23.7	4.04	274	715	11/25(18)	0.451	689	323	2.14(7)	151
602W		38.1	8.06	489	785	12/03(14)	0.308	1,334	568	2.36	241
893W		19.5	3.47	267	790	12/10(10)	0.221	1,155	1,342	2.50	537
798W		43.3	8.74	572	718	11/25(01)	0.466	5,069	1,256	2.61	481
899E	11/17	23.3	4.58	301	763	12/02(15)	0.477	1,971	887	2.44	364
713E	(08)	31.2	6.63	412	766	12/02(16)	0.476	2,293	772	2.35	329
880E		28.4	5.49	360	765	12/02(16)	0.476	1,240	459	2.33	197
886W		29.8	5.96	379	759	12/02(14)	0.477	3,781	1,330	2.34	568
622W		41.4	8.63	536	757	12/02(13)	0.477	3,515	890	2.44	365
698W		37.4	7.29	467	826	12/10(24)	0.317	2,024	854	2.38(7)	359

Table 1 cont'd
P-32 Uptake and Depuration in Bluegill
Muscle

Fish No.	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32: Date of counting, 1982(hr)(5)	P-32: decay fraction	P-32: net c/min	P-32: c/min.g. wet	P, mg/g	P-32/P, c/min.mg.
782E	11/20	34.6	7.31	444	846	12/12(22)	0.334	1,646	712	2.34	304
767E	(08)	48.7	10.52	582	849	12/16(10)	0.282	1,406	512	2.47	207
728E		46.7	10.41	592	848	12/13(01)	0.333	4,081	1,312	1.97(7)	666
715W		47.7	10.71	605	931	12/22(10)	0.211	1,454	722	2.73(7)	265
889W		44.5	10.11	596	1017	12/31(24)	0.133	1,283	1,084	2.66	408
606W		43.2	9.64	548	847	12/12(23)	0.334	1,762	611	1.98(7)	309
477E	11/24	39.4	8.26	483	876	12/16(20)	0.336	1,671	631	2.54	248
738E	(08)	31.3	6.39	431	845	12/12(20)	0.408	3,101	1,214	3.62(7)	335
691E		49.0	10.37	640	881	12/16(22)	0.335	2,467	751	2.41	312
668W		34.1	7.40	438	878	12/16(21)	0.336	1,856	810	2.50	324
717W		22.9	5.00	325	932	12/22(10)	0.256	1,372	1,170	2.72	430
891W		43.5	9.12	583	868	12/16(17)	0.338	1,872	637	2.50	255
637E	11/30	37.0	7.52	450	853	12/16(11)	0.458	1,785	527	2.52	209
721E	(08)	24.7	4.88	316	852	12/16(11)	0.458	854	377	2.54	148
723E		31.5	6.25	385	885	12/16(23)	0.446	1,291	459	2.55	180
892W		56.5	12.12	720	880	12/16(21)	0.449	4,748	935	2.58	362
885W		31.7	7.02	406	877	12/16(20)	0.449	2,101	738	2.64	280
636W		52.2	11.10	670	851	12/16(11)	0.458	3,010	630	2.74	230
730E	12/07	38.7	8.04	478	898	12/18(03)	0.365	1,670	591	2.65	223
871E	(08)	32.7	6.64	377	897	12/18(01)	0.367	652	272	2.33	117
705E		30.4	5.41	367	896	12/17(23)	0.368	720	322	2.45	131
641W		34.9	7.30	456	900	12/18(09)	0.361	1,664	660	2.63	251
615W		45.6	8.62	527	895	12/17(22)	0.368	1,919	572	2.33	246
735W		32.1	6.71	404	901	12/17(08)	0.379	1,556	639	2.54	252
694E	12/15	24.7	4.44	373	1088	01/14(15)	0.230	236	208	2.44	85.2
485E	(08)	38.4	7.36	498	1025	01/01(14)	0.434	784	235	2.62	89.7
894E		54.1	11.22	716	1089	01/14(15)	0.230	634	255	2.61	97.7
692W		55.0	11.54	677	998	12/30(16)	0.476	1,921	367	2.51	146
854W		57.0	12.62	748	1090	01/14(15)	0.230	643	245	2.72	90.1
630W		35.6	7.63	472	1091	01/14(16)	0.230	353	216	2.50	86.4

Table 3
P-32 Uptake in Catfish
Muscle

Fish No.(1)	Date of death, 1982 (hr)	Weight, (2) wet	dry	ashed	Sample No.	P-32 Date of counting, 1982 (hr)	decay fraction	net c/min.(3)	c/min.g. wet	P, mg/g	P-32/P, c/min.mg.
351E	08/16	69.1	17.1	955	101*(4)	09/17(13)	0.209	306	212	2.28	93.0
317E	(08)	93.9	--	1,130	17	08/31(17)	0.474	4,240	476	2.17	219.
362E		87.4	18.6	1,170	107	09/17(09)	0.212	199	53.7	2.26	23.8
395W		70.9	16.1	841	47*	09/07(21)	0.336	14.3	6.0	2.30	2.61
418W		66.8	15.4	601	16	08/31(03)	0.488	15.5	2.4	1.70	1.41
409W		105.3	26.3	1,260	15	08/31(02)	0.488	31.0	3.0	2.07	1.50
359E	08/17	78.3	18.5	1,360	22*	09/01(10)	0.481	537	143.	2.18	65.6
357E	(08)	32.9	10.1	498	104	09/17(03)	0.225	42.2	28.5	2.36	12.1
		34.5	9.06	461	109	09/17(17)	0.219	49.2	32.6	2.36	13.8
		33.1	8.72	475	112	09/17(21)	0.218	39.0	27.0	2.25	12.0
300E		47.5	14.1	664	100	09/17(13)	0.220	535	256	2.16	119.
		52.6	13.4	630	159	09/21(14)	0.183	547	284	2.42	117.
421W		95.5	21.3	1,430	23*	08/31(18)	0.493	414	87.9	1.71	51.4
422W		38.9	8.89	430	44	09/03(08)	0.439	18.6	5.4	2.25	2.40
		29.3	7.07	383	108	09/17(16)	0.219	13.8	10.8	2.22	4.86
380W		39.8	9.50	637	24	08/31(18)	0.493	157	40.0	1.85	21.6
		31.3	7.77	420	103	09/16(16)	0.230	85.4	59.3	2.25	26.4
		24.6	6.23	---	76	09/14(17)	0.252	55.0	44.5	2.37	18.8
365E	08/18	70.1	--	773	18	08/31(18)	0.522	1,518	207	3.02	68.5
361E	(08)	119.0	29.1	1,440	128	09/20(16)	0.199	2,627	555	2.48	224.
385E		98.6	24.4	1,110	160	09/21(14)	0.190	1,317	351	2.16(6)	163.
373W		79.9	19.3	1,030	127	09/20(15)	0.199	755	237	2.55	92.9
424W		86.1	21.5	1,020	126	09/20(15)	0.199	321	93.7	2.46	38.1
398W		49.7	10.0	446	195	09/29(07)	0.131	206	158	1.80(6)	87.8
307E	08/24	63.3	16.0	701	123	09/20(14)	0.264	7,137	2,140	2.17	986.
	(08)	35.6	8.78	444	124	09/20(14)	0.264	4,169	2,220	2.20	1,009.
449E		117.8	28.9	1,490	135	09/21(10)	0.256	2,965	492	2.37	208.
276E		70.6	18.4	838	116	09/20(11)	0.269	5,845	1,539	2.72	566.
372W		110.3	30.3	1,260	125	09/20(14)	0.264	1,038	178	2.25	79.1
401W		100.7	19.9	1,180	42	09/02(18)	0.627	10,280	814	2.26	360.
416W		88.7	20.2	1,020	114	09/20(11)	0.269	8,040	1,691	2.18	776.

(1) E fish received twice as much feed as W fish, at same specific activity (2) Wet and dry weight in gram; ashed weight in mg. (3) Duplicate 20-ml aliquots of 100-ml samples were analyzed for P-32 by Cherenkov counting with 50-min. counts when < 200 c/min and 10-min. counts when > 200 c/min. (4) One asterisk indicates a 200-ml solution and two asterisks, 250-ml. (5) Weight appears to be erroneous (6) Average of 2 or more measurements.

Table 3 cont'd
P-32 Uptake in Catfish
Muscle

Fish No.(1)	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32 Date of counting, 1982 (hr)	P-32 decay fraction	P-32 net c/min.	P-32 c/min.g. wet	P, mg/g	P-32/P, c/min.mg.
314E	8/26	45.4	10.9	489	257	10/08(14)	0.123	1,532	1,373	2.05(6)	670
	(08)	54.2	13.3	597	258	10/08(14)	0.123	1,844	1,384	2.07	669
369E		57.7	11.9	641	282	10/11(12)	0.107	2,401	1,950	2.27(6)	859
		47.3	9.89	545	276	10/11(09)	0.107	1,983	1,965	2.59	759
332E		46.2	10.7	536	279	10/11(10)	0.107	1,324	1,343	2.33	576
		43.7	10.5	496	278	10/11(10)	0.107	1,002	1,075	2.16	498
448W		31.5	7.64	383	284	10/12(17)	0.100	189	300	2.39	126
		43.2	10.0	495	275	10/11(09)	0.107	250	271	2.12(6)	128
439W		57.0	12.9	647	280	10/11(11)	0.107	2,333	1,918	2.15	892
		71.0	15.2	784	316	10/14(11)	0.092	2,349	1,790	2.14	836
389W		57.6	14.8	666	281	10/11(11)	0.107	1,741	1,416	2.27	624
		64.2	17.4	705	619	11/17(13)	0.018	347	1,493	2.26	661
355E	9/01	51.4	---	583	261	10/08(15)	0.164	2,242	1,330	2.16	616
	(08)	50.0	---	576	270	10/08(17)	0.164	2,466	1,501	2.31(6)	655
393E		77.0	16.5	903	671	11/23(12)	0.018	334	1,205	2.42	498
348E		33.4	7.68	377	674	11/23(13)	0.018	275	2,290	2.20	1,041
		38.0	9.03	430	752	12/02(13)	0.012	211	2,310	2.12(6)	1,090
414W		47.2	11.0	536	745	12/01(22)	0.012	98.2	867	2.13	407
		59.5	---	676	260	10/08(15)	0.164	1,528	783	2.14	366
403W		49.6	11.1	494	656	11/22(20)	0.018	22.7	127	1.93(6)	65.8
404W		65.9	---	759	271	10/08(17)	0.164	1,809	836	1.10(6)	760
		30.0	6.80	331	675	11/23(14)	0.018	188	1,741	2.48	702
321E	9/10	83.0	17.9	943	267	10/08(16)	0.254	741	176	2.30	76.5
363E	(08)	36.5	8.06	418	197	09/30(15)	0.374	2,083	763	2.24	341
		54.4	12.2	608	225	09/30(22)	0.370	3,142	780	2.14	364
356E		25.7	5.44	313	222	09/30(21)	0.370	202	106	2.34	45.3
387W		91.8	20.0	1,060	266	10/08(16)	0.254	4,263	914	2.48	369
429W		74.8	14.6	865	198	09/30(15)	0.374	2,111	377	2.22	170
431W		79.0	16.4	919	227	09/30(22)	0.370	1,893	324	2.30	141
428W	9/23	129.1	29.2	1,620	291	10/13(09)	0.379	10,950	1,119	2.56	437
410W	(08)	91.0	18.8	1,110	272	10/08(17)	0.474	7,943	921	2.47	373
390W		91.9	20.2	1,080	306	10/13(16)	0.374	1,750	255	2.40	106

Table 8
Non-food Uptake of 32-P

Fish No.(1)	Date of death,(2) 1982 (hr)	Weight, (3) wet	dry	ashed	Sample No.	P-32 Date of counting, 1982 (hr)	decay fraction	net c/min	c/min.g. wet	P, mg/g	P-32/P, c/min.mg.
						Bluegill Muscle					
683 B	12/10	57.7	11.2	714	927	12/21(20)	0.577	174	26.1	2.51	10.4
857 B	(12)	70.4	14.2	854	926	12/22(09)	0.562	196	24.8	2.40(5)	10.3
626 U		40.8	7.94	529	965	12/23(07)	0.537	33.5	7.6	2.54	2.99
628 U		22.1	4.44	298	917	12/19(10)	0.649	26.3	9.2	2.50	3.68
638 U		11.8	2.34	154	967	12/23(08)	0.537	22.0	17.4	2.61	6.67
878 U		38.5	7.59	509	920	12/19(14)	0.644	68.9	13.9	2.72	5.11
						Catfish Muscle					
210.1 B	12/17	61.4	14.0	725	1087	01/13(04)(4)	0.274	74.3	22.1	2.42	9.13
160.4 B	(11)	51.0	11.9	591	1072	01/12(08)	0.285	86.4	29.7	2.42	12.3
150.7 B		49.6	11.4	---	Lost	---	---	---	---	---	---
137.0 U		33.7	9.62	485	1086	01/13(01)	0.275	27.6	18.2	2.99(5)	6.09
117.4 U		35.8	8.09	413	1064	01/11(20)	0.292	26.8	12.8	2.56	5.00
128.0 U		38.3	8.90	436	1079	01/12(17)	0.280	37.1	17.3	2.36	7.33

Notes: (1) B: blocked esophagus; U: unblocked
(2) Bluegill exposure began on 12/6 (1700) except for #857 and 878 which were exposed from 12/8(11) to 12/12(11); catfish exposure began on 12/13(1100).
(3) Wet and dry weight in gram; ashed weight in mg.
(4) Month 01 is in 1983.
(5) Average of 2 or more measurements.

Table 10

Bluegill and Catfish Wet Weights in Test of Non-food Uptake

Fish Number		Weight, g Start	Weight, g End
		Bluegill	
683	B	255.7	265.4
857	B	237.4	239.2
626	U	196.6	193.5
628	U	70.2	70.1
638	U	43.7	42.6
878	U	193.8	190.5
		Catfish	
210.1	B	217.8	210.1
160.4	B	168.5	160.4
150.7	B	154.6	150.7
137.0	U	139.1	137.0
117.4	U	122.5	117.4
128.0	U	137.4	128.0

Table 11a
P-32 Uptake in Worm-fed Bluegill and Catfish Maintained in Aquaria for Nine Days

Feed %	Temp. C°	Fish No.	Weight Wet	Dry	Ash	Sample No.	Date of counting, 1983(hr)	Decay fraction	Net c/min.	c/min.g. wet	P mg/g	P-32 c/min.mg
							Bluegill Muscle					
1.5	15	1-1	45.3	9.77	596	1198	02/08(10)	0.559	1,148.	227.	2.66	85.3
1.5	15	1-2	29.4	6.40	379	1315	02/16(13)	0.377	32.9	14.8	2.64	5.60
1.5	15	1-3	31.1	6.20	396	1241	02/09(11)	0.531	380.	115.	2.52	45.6
1.5	20	2-1	27.4	5.82	327	1289	02/15(05)	0.402	775.	352.	2.35	150.6
1.5	20	2-2	25.7	4.92	268	1201	02/07(23)	0.572	39.2	13.3	1.93	6.89
1.5	20	2-3	43.7	9.43	559	1317	02/15(23)	0.388	4,126	1217.	2.57	474.
3.0	20	3-1	24.6	5.31	307	1262	02/14(20)	0.409	2,325	1,155	2.58	448.
3.0	20	3-2	24.0	4.14	294	1342	02/16(08)	0.381	329	180	2.39	75.3
3.0	20	3-3	50.2	11.0	619	1220	02/08(23)	0.545	9,772	1,786	2.62	682.
1.5	25	4-1	33.9	4.22	287	1215	02/08(13)	0.504	1,305	382	1.82(5)	210.
1.5	25	4-2	27.8	5.39	340	1219	02/08(14)	0.554	1,630	529	2.25(5)	235.
1.5	25	4-3	41.5	8.87	495	1221	02/08(14)	0.554	1,802	392	2.51	156.
2.25	25	5-1	32.3	4.94	263	1242	02/09(12)	0.530	1,683	492	1.33(5)	370.
2.25	25	5-2	33.3	6.94	406	1222	02/08(15)	0.554	2,843	771	2.28	338.
2.25	25	5-3	34.4	7.28	445	1345	02/21(16)	0.294	1,438	711	2.71	262.
3.0	25	6-1	32.8	5.01	310	Lost	---	---	---	---	---	---
3.0	25	6-2	27.5	4.44	222	1195	02/07(18)	0.577	11.6	3.6	1.31(5)	2.77
3.0	25	6-3	25.6	5.30	312	1316	02/05(22)	0.389	1,220	562.	2.21(5)	254.
3.0	25	6-4	51.7	11.5	600	1261	02/14(20)	0.409	6,825	1,614	2.49	648.
							Catfish Muscle					
1.5	25	7-1	92.3	22.9	1,094	1343	02/16(08)	0.381	8,663	1,232	2.50	493.
1.5	25	7-2	53.6	12.8	603	1287	02/15(05)	0.402	6,454	1,498	2.32	646.
1.5	25	7-3	51.1	12.1	621	1263	02/14(21)	0.409	1,926	461	2.26	204.
3.0	25	8-1	49.0	11.6	908	1284	02/15(04)	0.403	3,221	816	2.26	361.
3.0	25	8-2	47.8	11.8	540	1243	02/09(12)	0.530	7,251	1,431	2.26	633.
3.0	25	8-3	48.4	10.7	549	1255	02/14(18)	0.411	9,783	1,907	2.29	833.

Notes: 1) Exposure period was 01/18-01/27(10) except fish 4-1 was removed on 01/25, 5-1, on 01/26, and 6-1, on 01/20 because of illness, and fish 6-2 was exposed beginning 01/20. 2) Wet and dry wts. are in grams, ash weight is in mg. 3) Duplicate 20-ml aliquots of 100-ml samples were analyzed for P-32 by Cherenkov counting with 50-min. counts when < 200 c/min. and 10-min counts when > 200 c/min. 4) Actual average feed % is given in Table 13a. 5) Average of 2 or more measurements.

Table 11a (cont'd)

P-32 Uptake in Worm-fed Bluegill and Catfish Maintained in Aquaria for Nine Days

Feed %	Temp. C°	Fish No.	Weight Wet	Weight Dry	Weight Ash	Sample No.	Date of counting, 1983(hr)	Decay fraction	Net c/min.	c/min.g. wet	P mg/g	P-32 c/min.mg
							Bluegill Skeleton					
1.5	15	1-1	27.2	8.66	2,310	1207	02/08(12)	0.557	1,830	604		
1.5	15	1-2	23.6	7.49	2,010	1314	02/15(22)	0.389	144	78.4		
1.5	15	1-3	18.5	5.53	1,880	1244	02/09(12)	0.529	638	326		
1.5	20	2-1	18.7 ?	6.90	1,560	1291	02/15(06)	0.401	1,061	707		
1.5	20	2-2	18.0	5.59	1,650	1197	02/07(20)	0.575	44.1	21.3		
1.5	20	2-3	33.4	11.4	3,400	1356	02/22(12)	0.282	3,269	1,735		
3.0	20	3-1	20.8	6.48	1,840	1275	02/15(01)	0.406	3,321	1,966		
3.0	20	3-2	21.4	6.00	2,440	1248	02/14(16)	0.413	494	279		
3.0	20	3-3	35.0	11.5	2,840	1274	02/14(24)	0.406	7,363	2,590		
1.5	25	4-1	20.0	5.57	2,040	1203	02/08(11)	0.506	1,182	584		
1.5	25	4-2	15.7	4.90	1,570	1277	02/15(01)	0.406	2,013	1,579		
1.5	25	4-3	33.9	11.1	2,590	1224	02/08(15)	0.551	3,126	837		
2.25	25	5-1	18.1	5.24	1,890	1240	02/09(11)	0.531	2,566	1,335		
2.25	25	5-2	23.3	7.61	2,177	1225	02/08(12)	0.557	4,330	1,668		
2.25	25	5-3	23.6	9.85	2,662	1353	02/22(11)	0.283	2,102	1,574		
3.0	25	6-1	18.1	4.84	1,760	1176	02/03(05)	0.513	30.7	16.5		
3.0	25	6-2	12.6	3.75	1,350	1200	02/07(22)	0.573	14.8	10.2		
3.0	25	6-3	20.8	7.08	2,280	1318	02/15(23)	0.388	1,667	1,033		
3.0	25	6-4	30.7	9.52	2,280	1286	02/15(04)	0.403	7,474	3,020		
							Catfish Skeleton					
1.5	25	7-1	38.6	12.7	1,604	1340	02/16(07)	0.382	4,319	1,465		
1.5	25	7-2	25.5	8.19	874	1323	02/16(01)	0.386	3,738	1,899		
1.5	25	7-3	34.8	10.9	1,310	1245	02/14(12)	0.416	2,149	742		
3.0	25	8-1	28.9	8.69	1,100	1321	02/15(24)	0.387	2,139	956		
3.0	25	8-2	24.7	8.52	926	1273	02/14(24)	0.406	4,357	2,170		
3.0	25	8-3	26.7	8.30	945	1352	02/22(11)	0.283	4,563	3,020		

Table 11a (cont'd)

P-32 Uptake in Worm-fed Bluegill and Catfish Maintained in Aquaria for Nine Days

Feed %	Temp. C°	Fish No.	Weight Wet	Dry	Ash	Sample No.	Date of counting, 1983(hr)	Decay fraction	Net c/min.	c/min.g. wet	P mg/g	P-32 c/min.mg
							Bluegill Viscera					
1.5	15	1-1	11.0	2.69	113	1212	02/08(12)	0.557	4,144	3,380		
1.5	15	1-2	6.27	1.55	67.9	1331	02/16(04)	0.384	520	1,080		
1.5	15	1-3	6.70	130.	77.0	1339	02/16(07)	0.382	1,553	3,030		
1.5	20	2-1	5.53	1.55	56.3	1298	02/15(16)	0.393	1,862	4,280		
1.5	20	2-2	5.97	1.25	37.9	1214	02/08(13)	0.556	546	822		
1.5	20	2-3	10.1	2.44	110	1299	02/15(17)	0.393	4,346	5,470		
3.0	20	3-1	7.19	1.63	68.8	1279	02/15(02)	0.405	3,412	5,860		
3.0	20	3-2	3.68	0.516	47.5	1257	02/14(19)	0.410	610	2,020		
3.0	20	3-3	11.3	3.97	112	1272	02/14(24)	0.406	4,406	4,800		
1.5	25	4-1	5.17	0.879	39.3	1196	02/08(10)	0.507	707	1,349		
1.5	25	4-2	3.74	1.08	34.1	1235	02/09(10)	0.533	1,743	4,370		
1.5	25	4-3	8.29	2.56	99.6	1232	02/09(09)	0.534	3,310	3,740		
2.25	25	5-1	6.45	1.06	52.1	1337	02/16(06)	0.383	1,012	2,050		
2.25	25	5-2	8.24	1.94	92.7	1234	02/09(10)	0.533	4,603	5,240		
2.25	25	5-3	8.57	2.08	105	1341	02/16(08)	0.381	3,881	5,940		
3.0	25	6-1	6.26	0.870	46.6	1178	02/03(08)	0.509	<2.2	<3.5		
3.0	25	6-2	3.48	0.738	36.1	1213	02/08(20)	0.548	4.8	12.6		
3.0	25	6-3	5.30	1.38	73.7	1304	02/15(18)	0.392	1,906	4,590		
3.0	25	6-4	12.17	4.90	120	1281	02/15(03)	0.404	6,441	6,550		
							Catfish Viscera					
1.5	25	7-1	19.3	6.23	180	1326	02/16(02)	0.385	4,310	2,900		
1.5	25	7-2	9.00	3.35	71.5	1333	02/16(05)	0.384	2,151	3,110		
1.5	25	7-3	12.4	4.95	127	1344	02/16(09)	0.380	1,119	1,187		
3.0	25	8-1	8.66	3.26	72.4	1305	02/15(19)	0.391	1,403	2,070		
3.0	25	8-2	9.00	3.37	84.7	1249	02/14(16)	0.413	3,543	4,770		
3.0	25	8-3	12.0	3.67	115	1332	02/16(05)	0.384	5,175	5,620		

Table 11a (cont'd)

P-32 Uptake in Worm-fed Bluegill and Catfish Maintained in Aquaria for Nine Days

Feed %	Temp. C°	Fish No.	Weight Wet	Dry	Ash	Sample No.	Date of counting, 1983(hr)	Decay fraction	Net c/min.	c/min.g. wet	P mg/g	P-32 c/min.mg
							Bluegill Skin					
1.5	15	1-1	15.3	5.66	1,900	1202	02/08(11)	0.558	1,265.	741		
1.5	15	1-2	10.4	4.15	1,417	1350	02/22(23)	0.276	73.6	128		
1.5	15	1-3	9.69	3.99	1,550	1265	02/14(21)	0.409	407.	513		
1.5	20	2-1	7.19	2.96	1,040	1285	02/15(04)	0.403	491.	847		
1.5	20	2-2	7.76	3.12	1,200	1237	02/09(03)	0.540	16.2	19.3		
1.5	20	2-3	12.2	5.40	2,230	1330	02/16(04)	0.384	2,794	2,980		
3.0	20	3-1	7.13	3.13	1,210	1266	02/14(22)	0.407	1,882	3,240		
3.0	20	3-2	10.5	4.37	1,910	1276	02/15(01)	0.406	345	415		
3.0	20	3-3	13.8	5.65	2,160	1264	02/14(21)	0.409	5,252	4,650		
1.5	25	4-1	7.32	2.98	1,230	1206	02/08(12)	0.505	770	1,041		
1.5	25	4-2	8.21	3.07	897	1278	02/15(02)	0.405	1,155	1,737		
1.5	25	4-3	11.4	4.91	2,050	1230	02/09(09)	0.534	2,151	1,767		
2.25	25	5-1	8.02	3.28	1,430	1256	02/14(18)	0.411	1,805	2,720		
2.25	25	5-2	10.4	4.19	1,540	1223	02/08(15)	0.553	2,987	2,600		
2.25	25	5-3	15.4	6.73	2,890	1313	02/15(21)	0.390	1,908	1,588		
3.0	25	6-1	7.63	2.59	917	1177	02/03(06)	0.512	24.7	31.6		
3.0	25	6-2	3.99	1.61	654	1236	02/09(01)	0.542	8.3	19.2		
3.0	25	6-3	9.94	4.46	1,757	1354	02/22(11)	0.283	1,084	1,927		
3.0	25	6-4	19.5	6.65	1,970	1290	02/15(06)	0.400	5,728	3,670		
							Catfish Skin					
1.5	25	7-1	20.5	6.62	176	1348	02/21(16)	0.294	1,031	855		
1.5	25	7-2	8.89	2.46	56.2	1336	02/16(06)	0.383	519	762		
1.5	25	7-3	6.98	2.16	60.1	1251	02/14(17)	0.412	209	363		
3.0	25	8-1	8.28	2.75	64.2	1334	02/16(05)	0.384	331	521		
3.0	25	8-2	7.09	2.63	54.4	1311	02/15(21)	0.390	596	1,078		
3.0	25	8-3	11.8	3.63	96.5	1359	02/22(13)	0.282	973	1,462		

Table 11a (cont'd)

P-32 Uptake in Worm-fed Bluegill and Catfish Maintained in Aquaria for Nine Days

Feed %	Temp. C°	Fish No.	Weight Wet	Weight Dry	Weight Ash	Sample No.	Date of counting, 1983(hr)	Decay fraction	Net c/min.	c/min.g. wet	P mg/g	P-32 c/min.mg
							Bluegill Head					
1.5	15	1-1	42.3	12.8	3,040	1199	02/08(10)	0.559	2,958	625		
1.5	15	1-2	33.5	10.1	2,600	1319	02/15(23)	0.388	193	74.2		
1.5	15	1-3	33.9	9.10	2,740	1254	02/14(18)	0.411	982	352		
1.5	20	2-1	25.0	7.66	1,950	1329	02/16(04)	0.384	1,003.	522		
1.5	20	2-2	27.0	8.02	2,220	1204	02/08(01)	0.569	49.0	15.9		
1.5	20	2-3	53.4	16.9	4,790	1292	02/15(06)	0.400	7,266.	1,700		
3.0	20	3-1	27.9	8.39	2,280	1267	02/14(22)	0.407	3,836	1,689		
3.0	20	3-2	33.2	8.07	3,200	1247	02/14(12)	0.416	720	261		
3.0	20	3-3	50.4	15.7	3,830	1227	02/08(16)	0.552	11,910	2,140		
1.5	25	4-1	36.1	9.27	2,960	1205	02/08(11)	0.506	1,755	480		
1.5	25	4-2	27.0	7.59	1,990	1229	02/09(08)	0.535	3,258	1,128		
1.5	25	4-3	44.0	14.3	3,430	1226	02/08(16)	0.554	4,409	904		
2.25	25	5-1	33.5	8.64	2,630	1253	02/14(17)	0.412	3,571	1,294		
2.25	25	5-2	38.2	11.6	3,090	1228	02/09(08)	0.535	6,454	1,579		
2.25	25	5-3	47.8	14.9	4,540	1324	02/16(01)	0.386	2,854	773		
3.0	25	6-1	28.5	6.98	2,210	1175	02/03(03)	0.515	48.4	16.5		
3.0	25	6-2	20.0	5.09	1,560	1238	02/09(04)	0.539	17.7	8.2		
3.0	25	6-3	32.1	10.1	3,030	1325	02/16(01)	0.386	2,428	980		
3.0	25	6-4	50.3	15.3	3,280	1288	02/15(05)	0.402	10,480	2,590		
							Catfish Head					
1.5	25	7-1	65.1	21.3	4,430	1351	02/22(10)	0.279	5,591	1,539		
1.5	25	7-2	43.7	12.9	2,430	1322	02/15(24)	0.387	7,503	2,220		
1.5	25	7-3	40.7	13.2	2,650	1357	02/22(12)	0.277	2,121	941		
3.0	25	8-1	45.1	13.9	2,740	1320	02/15(24)	0.387	3,460	991		
3.0	25	8-2	44.0	14.3	2,590	1355	02/22(12)	0.277	5,937	2,440		
3.0	25	8-3	47.3	13.9	2,760	1246	02/14(12)	0.416	13,240	3,360		

Table 11a (cont'd)

P-32 Uptake in Worm-fed Bluegill and Catfish Maintained in Aquaria for Nine Days

Feed %	Temp. C°	Fish No.	Weight Wet	Weight Dry	Weight Ash	Sample No.	Date of counting, 1983 (hr)	Decay fraction	Net c/min.	c/min.g. wet	P mg/g	P-32 c/min.mg
							Bluegill Gills					
1.5	15	1-1	0.540	0.101	7.0	1210	02/08(06)	0.564	133.	2,180		
1.5	15	1-2	0.237	0.046	4.3	1338	02/16(15)	0.375	6.5	366		
1.5	15	1-3	0.485	0.087	6.1	1346	02/22(18)	0.279	40.6	1,500		
1.5	20	2-1	0.502	0.079	0.5	1297	02/16(12)	0.378	54.6	1,439		
1.5	20	2-2	0.502	0.129	3.7	1211	02/08(18)	0.550	4.8	86.9		
1.5	20	2-3	0.672	0.114	8.9	1302	02/15(18)	0.392	154.	2,920		
3.0	20	3-1	0.425	0.079	5.6	1303	02/15(18)	0.392	112.	3,360		
3.0	20	3-2	0.574	0.071	6.5	1358	02/22(23)	0.295	14.6	431		
3.0	20	3-3	0.692	0.122	9.7	1269	02/14(23)	0.407	232.	4,120		
1.5	25	4-1	0.653	0.059	2.7	1208	02/08(03)	0.515	48.4	720		
1.5	25	4-2	0.304	0.043	2.4	1268	02/14(22)	0.408	76.2	3,070		
1.5	25	4-3	0.560	0.103	6.7	1231	02/09(09)	0.534	136.	2,270		
2.25	25	5-1	0.773	0.094	12.0	1347	02/22(20)	0.278	62.4	1,452		
2.25	25	5-2	0.742	0.129	9.7	1233	02/09(10)	0.533	342.	4,320		
2.25	25	5-3	0.703	0.134	9.8	1295	02/15(15)	0.394	310.	5,600		
3.0	25	6-1	0.534	0.076	10.9	1179	02/03(10)	0.507	4.1	75.7		
3.0	25	6-2	0.269	0.042	5.4	1209	02/08(04)	0.566	2.4	78.8		
3.0	25	6-3	0.530	0.089	5.8	1310	02/15(20)	0.391	120.	2,900		
3.0	25	6-4	0.850	0.091	8.8	1280	02/15(02)	0.405	348.	5,050		
							Catfish Gills					
1.5	25	7-1	1.24	1.24	16.6	1293	02/15(07)	0.400	251.	2,530		
1.5	25	7-2	0.951	0.188	10.3	1294	02/15(07)	0.400	216.	2,840		
1.5	25	7-3	1.09	0.220	14.0	1270	02/14(23)	0.407	103.	1,161		
3.0	25	8-1	1.22	0.238	14.7	1349	02/22(21)	0.277	95.8	1,417		
3.0	25	8-2	0.828	0.164	10.6	1250	02/14(16)	0.413	246.	3,600		
3.0	25	8-3	1.08	0.215	12.5	1309	02/15(20)	0.391	335.	3,970		

Table 11a (cont'd)

P-32 Uptake in Worm-fed Bluegill and Catfish Maintained in Aquaria for Nine Days

Feed %	Temp. C°	Fish No.	Weight Wet	Weight Dry	Weight Ash	Sample No.	Date of counting, 1983(hr)	Decay fraction	Net c/min.	c/min.g. wet	P mg/g	P-32 c/min.mg
							Catfish Fin Spines					
1.5	25	7-1	0.712	0.494	261	1296	02/15(16)	0.393	291.	5,200		
1.5	25	7-2	0.395	0.251	129	1300	02/15(17)	0.392	212.	6,850		
1.5	25	7-3	0.451	0.302	151	1335	02/16(06)	0.382	105.	3,050		
3.0	25	8-1	0.493	0.312	168	1306	02/15(19)	0.391	122.	3,160		
3.0	25	8-2	0.363	0.226	118	1271	02/14(23)	0.407	245.	8,290		
3.0	25	8-3	0.390	0.254	126	1301	02/15(17)	0.392	244.	7,980		
							Catfish Fins					
1.5	25	7-1	8.41	3.33	370	1327	02/16(02)	0.385	1,226	1,893		
1.5	25	7-2	4.73	1.52	170	1312	02/15(21)	0.388	833	2,270		
1.5	25	7-3	4.17	1.63	206	1328	02/16(02)	0.385	365	1,137		
3.0	25	8-1	5.50	2.08	252	1307	02/15(19)	0.390	563	1,312		
3.0	25	8-2	4.13	1.64	214	1252	02/14(17)	0.412	1,147	3,370		
3.0	25	8-3	4.15	1.38	165	1308	02/15(20)	0.390	931	2,880		

Table 11b

P-32 Uptake in Pellet-fed Catfish and Bluegill Maintained in Aquaria for Nine Days

Feed %	Temp. C°	Fish No.	Weight Wet	Weight Dry	Weight Ash	Sample No.	Date of counting, 1983(hr)	Decay fraction	Net c/min.	c/min.g. wet	P mg/g	P-32 c/min.mg
							Catfish Muscle					
1.0	15	1-1	51.9	11.0	617	1527	03/14(18)	0.293	953.	313.	2.65	118.
1.0	15	1-2	44.7	10.4	506	1430	03/04(19)	0.475	23.6	5.6	2.15(5)	2.61
1.0	15	1-3	51.0	12.3	580	1530	03/12(09)	0.329	28.2	8.4	1.19(5)	7.06
1.0	20	3-1	51.2	12.2	569	1503	03/09(04)	0.384	36.4	9.3	2.21	4.21
1.0	20	3-2	33.0	7.22	350	1458	03/05(17)	0.454	15.4	5.1	2.19(5)	2.33
1.0	20	3-3	49.0	11.4	575	1382	02/25(20)	0.665	31.1	4.8	2.41	1.99
1.5	20	4-1	51.0	11.6	579	1477	03/09(09)	0.380	16,161	4,170	2.40	1,738.
1.5	20	4-2	45.5	10.2	528	1386	02/28(08)	0.589	16,270	3,036	2.60	1,168
1.5	20	4-3	53.3	12.0	590	1531	03/14(19)	0.292	9,049.	2,907	2.37	1,227
2.0	20	5-1	52.4	11.7	590	1524	03/14(17)	0.293	2,814	916	2.32	395
2.0	20	5-2	41.3	9.67	463	1433	03/07(14)	0.415	6,500	1,896	2.43	780
2.0	20	5-3	41.8	9.62	470	1529	03/14(19)	0.292	2,221	910	2.33	391
1.0	25	7-1	54.9	12.6	625	1508	03/09(17)	0.374	13,474	3,281	2.34	1,402
1.0	25	7-2	63.7	13.7	744	1525	03/14(18)	0.293	5,149	1,379	2.29	602
1.0	25	7-3	64.3	15.3	734	1523	03/14(17)	0.293	18,954	5,030	2.30	2,187
2.0	25	8-1	51.6	12.3	564	1528	03/14(19)	0.292	7,897	2,621	2.27	1,155
2.0	25	8-2	40.4	9.14	449	1526	03/14(18)	0.293	3,026	1,278	2.08(5)	614
2.0	25	8-3	42.6	9.96	464	1381	02/28(09)	0.588	6,881	1,374	2.27(5)	605
							Bluegill Muscle					
1.0	20	2-1	27.4	6.21	342	1456	03/07(17)	0.412	8,326	3,688	4.02(5)	917
1.0	20	2-2	17.4	3.55	201	1455	03/05(15)	0.456	54.1	34.1	2.60	13.1
1.0	20	2-3	36.2	7.81	455	1457	03/07(18)	0.411	7,620	2,561	2.51	1,020
2.0	20	6-1	21.6	4.40	259	1459	03/05(18)	0.453	171	87.3	2.16	40.4
2.0	20	6-2	27.5	5.05	303	1532	03/12(11)	0.327	27.4	15.2	2.37	6.41
2.0	20	6-3	33.3	7.20	424	1460	03/07(18)	0.411	18,270	6,675	2.45	2,724

Notes: (1) Exposure period was 02/08 - 02/17(10). (2) Wet and dry weights are in grams; ash weight is in mg. (3) Duplicate 20-ml aliquots of 100-ml samples were analyzed for P-32 by Cherenkov counting with 50-min counts < 200 c/min and 10-min counts when > 200 c/min. (4) Actual feed % was less for all fish (see Table 13b). (5) Average of 2 or more measurements.

Table 11b (cont'd)

P-32 Uptake in Pellet-fed Catfish and Bluegill Maintained in Aquaria for Nine Days

Feed %	Temp. C°	Fish No.	Weight Wet	Dry	Ash	Sample No.	Date of counting, 1983(hr)	Decay fraction	Net c/min.	c/min.g. wet	P mg/g	P-32 c/min.mg
							Catfish Skeleton					
1.0	15	1-1	26.0	7.25	1,060	1559	03/15(01)	0.289	630.	419.		
1.0	15	1-2	26.0	7.89	937	1383	02/25(21)	0.664	17.5	5.1		
1.0	15	1-3	22.3	7.49	922	1551	03/12(21)	0.319	11.9	8.4		
1.0	20	3-1	23.8	7.69	887	1485	03/08(17)	0.393	17.0	9.1		
1.0	20	3-2	26.5	7.76	844	1490	03/08(20)	0.390	18.6	9.0		
1.0	20	3-3	19.7	5.91	804	1435	03/04(21)	0.473	14.8	7.9		
1.5	20	4-1	24.8	8.01	996	1489	03/09(13)	0.377	7,907	4,229		
1.5	20	4-2	20.7	6.09	762	1434	03/07(14)	0.415	6,273	3,651		
1.5	20	4-3	27.9	8.23	810	1566	03/15(03)	0.287	5,389	3,365		
2.0	20	5-1	21.7	6.41	847	1486	03/09(12)	0.378	1,954	1,191		
2.0	20	5-2	18.2	5.69	736	1432	03/07(13)	0.415	3,824	2,531		
2.0	20	5-3	24.8	7.54	825	1555	03/14(24)	0.289	1,549	1,081		
1.0	25	7-1	33.5	10.2	1,010	1484	03/09(11)	0.379	11,989	4,721		
1.0	25	7-2	40.8	11.2	1,741	1534	03/14(20)	0.292	4,218	1,770		
1.0	25	7-3	26.2	8.12	985	1561	03/15(02)	0.288	10,394	6,887		
2.0	25	8-1	25.7	8.61	857	1556	03/15(01)	0.289	4,448	2,994		
2.0	25	8-2	20.3	6.04	730	1567	03/15(04)	0.287	1,606	1,378		
2.0	25	8-3	29.8	9.07	997	1431	03/07(13)	0.415	4,285	1,732		
							Bluegill Skeleton					
1.0	20	2-1	15.1	5.31	1,420	1475	03/09(09)	0.380	5,948	4,748		
1.0	20	2-2	17.4	5.19	1,670	1492	03/08(22)	0.389	135	99.7		
1.0	20	2-3	21.1	6.76	1,800	1506	03/09(16)	0.375	10,305	6,512		
2.0	20	6-1	15.4	4.87	1,480	1504	03/09(16)	0.375	251.	217		
2.0	20	6-2	17.4	5.42	1,730	1554	03/12(24)	0.319	56.2	50.6		
2.0	20	6-3	18.7	6.22	1,750	1509	03/09(17)	0.374	15,037	10,750		

Table 11b (cont'd)
P-32 Uptake in Pellet-fed Catfish and Bluegill Maintained in Aquaria for Nine Days

Feed %	Temp. C°	Fish No.	Weight Wet	Weight Dry	Weight Ash	Sample No.	Date of counting, 1983(hr)	Decay fraction	Net c/min.	c/min.g. wet	P mg/g	P-32 c/min.mg
							Catfish Viscera					
1.0	15	1-1	12.0	2.52	140	1536	03/14(20)	0.292	5,052	7,208		
1.0	15	1-2	11.0	3.38	101	1418	02/27(13)	0.612	32.1	23.8		
1.0	15	1-3	14.8	6.13	111	1498	03/09(01)	0.386	42.8	37.5		
1.0	20	3-1	10.8	3.86	86.6	1446	03/05(05)	0.465	14.4	14.3		
1.0	20	3-2	6.53	1.80	54.9	1454	03/05(13)	0.458	6.6	11.0		
1.0	20	3-3	9.49	3.47	74.4	1416	02/27(10)	0.616	41.1	35.2		
1.5	20	4-1	13.9	4.08	142	1550	03/14(24)	0.289	7,828	9,743		
1.5	20	4-2	12.0	4.17	123	1448	03/07(17)	0.412	6,837	6,914		
1.5	20	4-3	16.3	4.67	178	1515	03/09(19)	0.373	8,021	6,596		
2.0	20	5-1	11.8	3.63	123	1499	03/09(15)	0.376	2,231	2,514		
2.0	20	5-2	14.2	4.22	159	1420	02/27(18)	0.606	13,271	7,711		
2.0	20	5-3	15.5	5.04	166	1537	03/14(21)	0.291	4,520	5,011		
1.0	25	7-1	12.8	3.04	125	1544	03/14(22)	0.291	5,953	7,991		
1.0	25	7-2	11.4	2.44	119	1514	03/09(19)	0.373	5,866	6,898		
1.0	25	7-3	22.3	7.77	272	1463	03/07(19)	0.410	16,488	9,017		
2.0	25	8-1	15.1	6.17	120	1470	03/07(21)	0.409	4,818	3,901		
2.0	25	8-2	8.69	2.47	93.4	1548	03/14(23)	0.290	2,925	5,803		
2.0	25	8-3	13.2	3.96	146	1414	02/28(13)	0.583	8,330	5,412		
							Bluegill Viscera					
1.0	20	2-1	7.22	2.02	96.7	1465	03/07(19)	0.410	10,098	17,060		
1.0	20	2-2	3.45	0.624	42.0	1467	03/05(22)	0.450	301	969		
1.0	20	2-3	13.0	3.40	201	1469	03/07(20)	0.410	22,769	21,360		
2.0	20	6-1	4.19	0.911	56.5	1462	03/07(18)	0.411	1,220	3,542		
2.0	20	6-2	4.40	0.869	48.7	1427	03/04(16)	0.478	198	471		
2.0	20	6-3	10.9	3.12	169	1468	03/07(20)	0.410	20,648	23,100		

Table 11b (cont'd)

P-32 Uptake in Pellet-fed Catfish and Bluegill Maintained in Aquaria for Nine Days

Feed %	Temp. C°	Fish No.	Weight Wet	Dry	Ash	Sample No.	Date of counting, 1983(hr)	Decay fraction	Net c/min.	c/min.g. wet	P mg/g	P-32 c/min.mg
							Catfish Skin					
1.0	15	1-1	10.5	2.72	89.1	1535	03/14(20)	0.292	293	478		
1.0	15	1-2	9.16	2.88	70.3	1415	02/27(09)	0.617	19.4	17.1		
1.0	15	1-3	10.0	3.16	77.0	1443	03/04(24)	0.470	12.2	13.0		
1.0	20	3-1	12.7	4.60	107	1403	02/26(22)	0.631	29.0	18.1		
1.0	20	3-2	7.24	2.20	55.9	1406	02/26(24)	0.629	12.0	13.2		
1.0	20	3-3	10.1	3.60	72.7	1417	02/27(12)	0.613	8.9	7.2		
1.5	20	4-1	8.94	2.76	63.8	1542	03/14(22)	0.291	1,124	2,160		
1.5	20	4-2	8.05	2.41	62.7	1402	02/28(11)	0.586	1,763	1,869		
1.5	20	4-3	8.58	2.57	65.6	1500	03/09(15)	0.375	1,171	1,820		
2.0	20	5-1	12.1	3.68	103	1413	02/28(12)	0.584	1,025	725		
2.0	20	5-2	8.25	2.71	62.2	1411	02/28(12)	0.584	1,325	1,375		
2.0	20	5-3	7.90	2.84	56.6	1543	03/14(22)	0.291	267	581		
1.0	25	7-1	9.04	2.77	66.5	1520	03/14(16)	0.294	1,127	2,120		
1.0	25	7-2	9.82	2.79	76.1	1495	03/09(14)	0.376	782	1,060		
1.0	25	7-3	9.46	3.12	68.0	1471	03/09(08)	0.381	2,048	2,841		
2.0	25	8-1	9.42	3.23	67.7	1464	03/07(19)	0.410	1,251	1,620		
2.0	25	8-2	8.76	2.73	70.7	1472	03/09(08)	0.381	611	915		
2.0	25	8-3	8.32	2.71	65.6	1408	02/28(12)	0.585	1,027	1,055		
							Bluegill Skin					
1.0	20	2-1	7.54	3.25	1,130	1511	03/09(18)	0.373	2,982	5,301		
1.0	20	2-2	8.26	3.15	1,890	1474	03/08(11)	0.397	111	169		
1.0	20	2-3	7.32	2.99	1,090	1478	03/09(10)	0.379	6,389	11,510		
2.0	20	6-1	5.91	2.79	1,110	1479	03/08(13)	0.396	168	359		
2.0	20	6-2	8.61	3.44	1,320	1557	03/13(02)	0.317	19.2	35.2		
2.0	20	6-3	7.54	3.32	1,230	1510	03/09(18)	0.373	8,682	15,440		

Table 11b (cont'd)
P-32 Uptake in Pellet-fed Catfish and Bluegill Maintained in Aquaria for Nine Days

Feed %	Temp. C°	Fish No.	Weight Wet	Dry	Ash	Sample No.	Date of counting, 1983(hr)	Decay fraction	Net c/min.	c/min.g. wet	P mg/g	P-32 c/min.mg
							Catfish Head					
1.0	15	1-1	48.5	14.2	4,080	1564	03/15(03)	0.287	1,277	459		
1.0	15	1-2	44.5	13.0	2,640	1384	02/25(23)	0.661	33.3	5.7		
0.319	15	1-3	39.7	12.6	2,600	1552	03/12(23)	0.319	21.9	8.6		
1.0	20	3-1	40.2	12.8	2,610	1487	03/08(18)	0.392	30.4	9.6		
1.0	20	3-2	34.0	9.51	1,860	1533	03/12(13)	0.326	30.6	13.8		
1.0	20	3-3	40.8	12.8	2,820	1385	02/26(01)	0.658	27.7	5.2		
1.5	20	4-1	43.7	13.3	2,860	1491	03/09(13)	0.377	14,902	4,522		
1.5	20	4-2	37.7	11.2	2,320	1436	03/07(14)	0.414	14,027	4,494		
1.5	20	4-3	44.6	13.0	2,380	1553	03/14(24)	0.289	8,835	3,427		
2.0	20	5-1	36.9	11.0	2,480	1493	03/09(13)	0.377	3,626	1,303		
2.0	20	5-2	33.9	10.8	2,270	1437	03/07(15)	0.414	8,313	2,962		
2.0	20	5-3	38.7	12.0	2,390	1562	03/15(02)	0.288	2,576	1,156		
1.0	25	7-1	52.9	14.1	2,880	1502	03/09(15)	0.375	23,891	6,022		
1.0	25	7-2	66.1	19.3	5,530	1488	03/09(12)	0.378	9,751	1,951		
1.0	25	7-3	43.7	13.1	2,776	1560	03/15(01)	0.289	18,723	7,412		
2.0	25	8-1	54.9	16.9	3,019	1565	03/15(03)	0.287	9,077	2,880		
2.0	25	8-2	41.1	12.5	2,652	1563	03/15(02)	0.288	3,242	1,369		
2.0	25	8-3	38.9	12.5	2,440	1438	03/07(15)	0.414	7,258	2,253		
							Bluegill Head					
1.0	20	2-1	25.4	8.21	1,970	1505	03/09(16)	0.375	7,221	3,791		
1.0	20	2-2	27.9	7.58	2,360	1480	03/08(15)	0.394	215	97.8		
1.0	20	2-3	31.9	9.41	2,300	1507	03/09(17)	0.374	12,991	5,444		
2.0	20	6-1	24.3	7.31	1,990	1461	03/05(20)	0.451	344	157		
2.0	20	6-2	23.5	7.07	2,050	1558	03/13(04)	0.316	47.4	31.9		
2.0	20	6-3	30.4	9.02	2,290	1476	03/09(09)	0.380	20,188	8,738		

Table 11b (cont'd)

P-32 Uptake in Pellet-fed Catfish and Bluegill Maintained in Aquaria for Nine Days

Feed %	Temp. C°	Fish No.	Weight Wet	Dry	Ash	Sample No.	Date of counting, 1983(hr)	Decay fraction	Net c/min.	c/min.g. wet	P mg/g	P-32 c/min.mg
							Catfish Gills					
1.0	15	1-1	1.08	0.194	13.4	1540	03/12(16)	0.324	83.5	1,193		
1.0	15	1-2	1.09	0.175	12.2	1396	02/26(17)	0.637	<2.1	<15		
1.0	15	1-3	0.975	0.177	11.5	1393	02/26(12)	0.644	3.9	31.1		
1.0	20	3-1	1.34	0.237	16.3	1392	02/26(11)	0.645	4.0	23.1		
1.0	20	3-2	1.27	0.214	14.5	1387	02/26(02)	0.657	3.7	22.2		
1.0	20	3-3	0.985	0.173	11.4	1378	02/25(18)	0.668	5.1	38.8		
1.5	20	4-1	0.989	0.182	11.5	1541	03/14(21)	0.291	344	5,976		
1.5	20	4-2	0.758	0.132	9.0	1421	03/07(11)	0.417	274	4,334		
1.5	20	4-3	0.885	0.143	8.9	1513	03/09(19)	0.372	309	4,693		
2.0	20	5-1	0.814	0.145	9.2	1389	02/26(06)	0.652	213	2,007		
2.0	20	5-2	0.752	0.139	8.2	1419	02/27(16)	0.609	329	3,592		
2.0	20	5-3	1.04	0.179	20.5	1539	03/12(14)	0.325	100	1,479		
1.0	25	7-1	1.11	0.187	9.2	1517	03/09(20)	0.372	721	8,731		
1.0	25	7-2	1.56	0.261	16.7	1512	03/09(18)	0.373	576	4,949		
1.0	25	7-3	0.856	0.160	9.8	1424	03/07(12)	0.416	824	11,570		
2.0	25	8-1	1.52	0.202	12.1	1516	03/09(20)	0.372	435	3,847		
2.0	25	8-2	0.695	0.128	11.0	1444	03/04(24)	0.470	212	3,245		
2.0	25	8-3	1.11	0.196	12.2	1405	02/28(11)	0.586	564	4,335		
							Bluegill Gills					
1.0	20	2-1	0.539	0.101	6.3	1452	03/05(10)	0.460	678	13,670		
1.0	20	2-2	0.406	0.060	3.9	1451	03/05(08)	0.462	10.8	288		
1.0	20	2-3	0.782	0.143	10.4	1450	03/07(17)	0.412	648	10,060		
2.0	20	6-1	0.344	0.063	3.7	1453	03/05(12)	0.459	19.8	627		
2.0	20	6-2	0.436	0.080	5.9	1521	03/12(07)	0.330	3.0	104		
2.0	20	6-3	0.667	0.122	8.6	1426	03/07(12)	0.416	824	14,850		

Table 11b (cont'd)
P-32 Uptake in Pellet-fed Catfish and Bluegill Maintained in Aquaria for Nine Days

Feed %	Temp. C°	Fish No.	Weight Wet	Weight Dry	Weight Ash	Sample No.	Date of counting, 1983(hr)	Decay fraction	Net c/min.	c/min.g. wet	P mg/g	P-32 c/min.mg
							Catfish Fin Spines					
1.0	15	1-1	0.778	0.471	280	1519	03/12(06)	0.331	62.0	1,204		
1.0	15	1-2	0.453	0.226	120	1388	02/26(04)	0.654	2.1	35.4		
1.0	15	1-3	0.390	0.211	114	1428	03/04(17)	0.477	3.2	86.0		
1.0	20	3-1	0.426	0.247	128	1397	02/26(19)	0.635	2.5	46.2		
1.0	20	3-2	0.373	0.198	107	1391	02/26(09)	0.648	<2.1	<43		
1.0	20	3-3	0.434	0.249	134	1394	02/26(14)	0.641	<2.1	<31		
1.5	20	4-1	0.427	0.223	116	1518	03/09(20)	0.372	292	9,191		
1.5	20	4-2	0.363	0.202	111	1399	02/28(10)	0.587	413	9,691		
1.5	20	4-3	0.388	0.189	95.2	1494	03/08(23)	0.388	210	6,975		
2.0	20	5-1	0.383	0.219	122	1395	02/26(16)	0.639	135	2,758		
2.0	20	5-2	0.421		93.5	1390	02/26(07)	0.650	233	4,257		
2.0	20	5-3	0.388	0.196	100	1398	02/26(21)	0.632	124	2,528		
1.0	25	7-1	0.491	0.229	116	1522	03/14(17)	0.294	417	14,440		
1.0	25	7-2	0.780	0.474	293	1501	03/09(03)	0.385	169	2,814		
1.0	25	7-3	0.413	0.231	123	1425	03/07(12)	0.416	750	21,830		
2.0	25	8-1	0.421	0.210	113	1422	03/07(11)	0.417	321	9,142		
2.0	25	8-2	0.393	0.218	121	1423	03/04(14)	0.479	113	3,001		
2.0	25	8-3	0.447	0.227	119	1410	02/27(05)	0.622	246	4,424		

Table 11b (cont'd)
P-32 Uptake in Pellet-fed Catfish and Bluegill Maintained in Aquaria for Nine Days

Feed %	Temp. C°	Fish No.	Weight Wet	Dry	Ash	Sample No.	Date of counting, 1983(hr)	Decay fraction	Net c/min.	c/min.g. wet	P mg/g.	P-32 c/min.mg
							Catfish Fins					
1.0	15	1-1	5.22	1.59	270	1545	03/12(18)	0.322	349	1,038		
1.0	15	1-2	5.10	1.97	223	1412	02/27(07)	0.620	8.1	12.8		
1.0	15	1-3	3.90	1.42	187	1409	02/27(04)	0.623	7.7	15.8		
1.0	20	3-1	3.73	1.39	181	1404	02/26(24)	0.629	8.5	18.1		
1.0	20	3-2	4.34	1.59	190	1445	03/05(04)	0.466	<2.1	<5		
1.0	20	3-3	3.94	1.43	196	1449	03/05(07)	0.463	3.5	9.6		
1.5	20	4-1	4.71	1.57	199	1549	03/14(23)	0.290	1,306	4,781		
1.5	20	4-2	3.82	1.25	162	1447	03/07(16)	0.413	1,285	4,072		
1.5	20	4-3	5.18	1.69	204	1497	03/09(14)	0.376	1,494	3,835		
2.0	20	5-1	4.85	1.61	204	1439	03/04(22)	0.472	653	1,426		
2.0	20	5-2	3.15	1.18	149	1429	03/07(13)	0.415	766	2,930		
2.0	20	5-3	4.15	1.46	198	1546	03/12(19)	0.322	382	1,428		
1.0	25	7-1	5.85	1.79	227	1538	03/14(21)	0.291	2,021	5,936		
1.0	25	7-2	8.13	2.50	400	1446	03/05(05)	0.465	14.4	19.0		
1.0	25	7-3	4.35	1.48	188	1466	03/07(20)	0.409	3,039	8,541		
2.0	25	8-1	4.68	1.67	202	1547	03/14(23)	0.290	1,051	3,872		
2.0	25	8-2	4.32	1.58	212	1473	03/09(08)	0.381	567	1,722		
2.0	25	8-3	4.86	1.82	208	1407	02/28(11)	0.586	1,296	2,275		

Table 12a

P-32 Concentration in Worms Fed to Bluegill & Catfish

Feeding Date, 1983	Amount fed, g	Vial No.	Weight, mg Dry	Weight, mg Ash	No. of worms	Counting date, 1983 (hr)	Decay factor	P-32 net c/min.	P-32 c/min. g
01/18	64.5	1360	207	14.6	4	02/22(13)	0.182	356	4,890
		1361	263	16.2	8	02/22(13)	0.182	759	10,430
01/19	62.8	1362	297	18.7	8	02/22(14)	0.191	2,298	30,080
		1363	295	18.8	6	02/22(14)	0.191	2,173	28,440
01/20	67.0	1364	264	16.2	8	02/22(14)	0.200	1,500	18,750
		1365	318	18.4	8	02/22(15)	0.200	1,571	19,640
01/21	71.5	1366	259	15.2	6	02/22(15)	0.210	1,885	22,440
		1367	335	18.5	9	02/22(15)	0.210	1,979	23,560
01/22	64.2	1368	285	16.4	9	02/22(16)	0.220	2,441	27,740
		1369	267	13.5	6	02/22(16)	0.220	1,566	17,800
01/23	61.2	1370	256	15.8	9	02/23(07)	0.224	1,194	13,330
01/24	68.5	1371	251	14.0	11	02/23(07)	0.235	1,385	14,730
01/25	68.5	1372	271	14.8	5	02/23(08)	0.246	1,900	19,310
		1373	315	18.6	9	02/23(08)	0.246	2,233	22,690
01/26	68.5	1374	272	14.7	8	02/23(08)	0.258	1,541	14,930
		1375	310	16.3	8	02/23(09)	0.258	1,812	17,560

Notes: 1) Feed samples were 2 g moist weight; 20-ml aliquots of 100-ml samples were counted.
2) Amount fed is moist weight; amount of feed was based on fish weight.
3) P-32 added to worm feed was 3.21×10^5 c/min.g worm wet weight

Table 12b

P-32 Concentration in Pellets Fed to Bluegill & Catfish

Feeding Date, 1983	Amount fed, g	Vial No.	Weight, mg		Counting date, 1983 (hr)	Decay factor	P-32	
			Dry	Ash			net c/min.	c/min. g
02/08	12.3	1568	545	58.5	03/18(10)	0.159	5,053	291,600
		1569	579	60.9	03/18(11)	0.158	5,545	301,400
02/09	12.3	1570	477	51.2	03/18(11)	0.166	4,856	306,700
		1571	561	59.6	03/18(11)	0.166	5,546	297,700
02/10	12.3	1572	565	53.8	03/18(12)	0.174	5,934	301,800
		1573	638	68.0	03/18(12)	0.174	6,258	281,900
02/11	12.3	1574	535	53.8	03/18(12)	0.183	5,699	291,000
		1575	608	64.3	03/18(13)	0.182	6,770	305,900
02/12	12.3	1576	563	58.5	03/18(13)	0.191	6,615	307,600
		1577	665	68.6	03/18(13)	0.191	7,395	291,100
02/13	12.3	1578	491	51.4	03/18(14)	0.200	6,048	307,900
		1579	422	45.2	03/18(14)	0.200	5,255	311,400
02/14	24.5	1580	426	44.8	03/18(14)	0.210	5,409	302,300
		1581	689	74.7	03/18(15)	0.210	8,723	301,500
02/15	37.0	1582	588	58.5	03/18(15)	0.220	7,626	294,700
		1583	660	69.1	03/18(15)	0.220	8,601	296,200
02/16	37.0	1584	603	61.5	03/18(16)	0.231	8,413	302,000
		1585	721	73.2	03/18(16)	0.231	9,733	292,200

Notes: 1. Feed samples were dry weight as shown; 20-ml aliquots of 100-ml samples were counted.
2. Amount fed is dry weight; amount of feed was based on fish weight.
3. P-32 added was 3.36×10^5 c/min.g pellet.

Table 13a

Fish Weights and Amount Fed (Worms)

Tank No.	Fish No.	Comments(1)	Fish wt., g Start	End	Amount fed, g	Feeding ratio, g/d. 100 g.wt.
1(B)	1-1	---	150.0	149.3	28.8	0.87
	1-2	---	118.0	111.0		
	1-3	---	107.0	107.9		
2(B)	2-1	2	103.1	88.8	49.4	1.61
	2-2	3	107.6	91.2		
	2-3	1 01/19-22	161.2	161.2		
3(B)	3-1	---	99.3	91.0	95.4	2.93
	3-2	---	109.0	97.6		
	3-3	1	167.0	172.8		
4(B)	4-1	---	106.7	110.0	47.6	1.53
	4-2	---	98.8	87.8		
	4-3	1	154.3	147.6		
5(B)	5-1	2	129.3	111.7	82.8	2.42
	5-2	1	104.1	122.0		
	5-3	3 01/23-25	173.4	146.3		
6(B)	6-1	---	73.0	74.3	91.1	2.94
	6-2	---	95.0	100.3		
	6-3	---	164.6	169.1		
7(C)	7-1		271.0	262.4	75.5	1.45
	7-2		160.0	152.5		
	7-3		169.0	160.6		
8(C)	8-1		167.1	156.1	126.1	3.01
	8-2		155.0	147.6		
	8-3		169.0	161.2		

B: bluegills; C: catfish

(1) Number indicated order of feeding and/or territorial dominance determined by observation; date refers to period for which fish was isolated by screen. Isolated fish were fed approximately one-third of daily feed.

Table 13b

Fish Weights and Amount Fed (Pellets)

Tank No.	Fish No.	Comments(1)	Fish wt., g Start	End	Amount fed, g	Feeding ratio, g/d. 100 g.wt.
1(C)	1-1		166.0	163.0	16.8	0.41
	1-2		158.0	148.0		
	1-3		158.0	149.6		
2(B)	2-1	3	---	86.5	10.5	0.41
	2-2	2	---	80.2		
	2-3	1 02/07-17	104.5	115.8		
3(C)	3-1		178.5	150.5	17.7	0.48
	3-2		137.5	118.2		
	3-3		169.0	140.8		
4(C)	4-1		150.0	154.8	25.0	0.62
	4-2		133.7	134.6		
	4-3		173.0	163.2		
5(C)	5-1		163.0	148.5	32.8	0.88
	5-2		122.3	126.4		
	5-3		141.5	140.0		
6(B)	6-1	---	86.5	75.6	19.0	0.79
	6-2	---	94.4	86.2		
	6-3	1	94.5	105.7		
7(C)	7-1		182.0	181.4	17.5	0.34
	7-2		210.0	212.4		
	7-3		171.0	180.0		
8(C)	8-1		165.0	171.5	32.3	0.80
	8-2		146.0	133.7		
	8-3		152.5	146.3		

B: bluegill; C: catfish

(1) Number indicated order of feeding and/or territorial dominance determined by observation; date refers to period for which fish was isolated by screen. Isolated fish was fed approximately one-third of daily feed.

Table 14a

P-32 in Aquarium Water During 9-day Studies of Worm-fed Bluegill and Catfish

Aquarium No.	Vial No.	Counting date, 1983 (hr)	Decay factor	P-32 net c/min.	P-32 c/min.L
1	1193	02/04(17)	0.644	848	823
2	1194	02/04(18)	0.643	572	556
3	1217	02/08(13)	0.535	1,064	1,243
4	1218	02/08(14)	0.534	553	674
5	1239	02/09(11)	0.512	1,105	1,349
	1258	02/14(19)	0.395	821	1,299
6	1259	02/14(19)	0.395	911	1,441
7	1260	02/14(20)	0.394	153	243
	1282	02/15(03)	0.389	156	251
8	1283	02/15(03)	0.389	411	660

Notes: 1) 4-l samples of 70 l water in each aquarium were collected at daily water change on 1/26(15); samples were filtered with a 75-μ mesh and processed to 50 ml volumes.
2) Samples are 20-ml aliquots of 50 ml.

Table 14b

P-32 in Aquarium Water During 9-day Studies of Pellet-fed Bluegill and Catfish

Aquarium No.	Vial No.	Counting date, 1983 (hr)	Decay factor	P-32 net c/min.	P-32 c/min.L
1	1379	02/28(08)	0.567	1,332	1,468
2	1380	02/28(09)	0.566	311	343
3	1400	02/28(10)	0.565	925	1,023
4	1401	02/28(10)	0.565	796	881
5	1440	03/07(15)	0.398	9,061	14,230
	1441	03/07(16)	0.397	9,316	14,670
6	1442	03/07(16)	0.397	5,192	8,174
7	1481	03/09(10)	0.365	1,826	3,127
	1482	03/09(10)	0.365	2,016	3,452
8	1483	03/09(11)	0.364	8,161	14,110
In	1376	02/23(01)	0.807	<2.1	<1.6
	1377	02/23(02)	0.806	8.7	6.7

Notes: 1) 4-l samples of 70 l water in each aquarium were collected at daily water change on 2/16(15); samples were filtered with a 75-μ mesh and processed to 50 ml volumes.
2) Samples are 20-ml aliquots of 50 ml.

Table 15a

Weight Balances for Dissected Bluegill

Fish No.	Date of death, 1982 (hr)	Total Wet Weight, gm Sum	Death Weight	Percent
761E	09/28	106.2	114.5	92.8
794E	(08)	111.7	119.6	93.4
879E		146.3	153.3	95.4
499W		117.0	121.6	96.2
708W		114.7	123.6	92.8
787W		139.3	149.4	93.3
684E	09/29	152.1	156.5	97.2
859E	(08)	136.0	139.8	97.3
863E		89.0	93.6	95.1
608W		101.6	107.9	94.2
682W		136.3	148.7	91.6
890W		133.2	139.7	95.4
619E	09/30	105.4	122.4	86.1
872E	(08)	146.4	153.5	95.3
635E		131.6	142.5	92.4
706W		124.7	133.8	93.2
704W		111.0	119.2	93.1
480W		148.5	158.5	93.7
759E	10/06	98.1	98.6	99.5
674E	(08)	95.1	102.4	92.9
762E		107.1	114.0	94.0
613W		95.2	103.5	92.0
680W		78.0	82.4	94.7
792W		103.7	109.2	95.0
699E	10/12	139.8	147.2	95.0
784E	(08)	141.9	148.3	95.7
733E		103.2	107.6	95.9
488W		111.1	118.5	93.8
490W		92.1	98.5	93.5
476W		158.2	164.9	96.0

Table 15a (cont'd)

Weight Balances for Dissected Bluegill

Fish No.	Date of death, 1982 (hr)	Total Wet Weight, gm Sum	Death Weight	Percent
769E	10/19	96.3	101.4	95.0
482E	(08)	88.3	92.9	95.0
677E		102.5	116.1	88.2
497W		83.1	86.9	95.6
873W		153.9	161.4	95.3
607W		167.4	172.4	97.1
876E	10/26	98.6	105.0	93.9
763E	(08)	129.7	140.5	92.3
381E		78.2	85.9	91.0
785W		133.9	147.6	90.7
716W		137.8	148.6	92.7
875W		150.0	158.2	94.8
882E	11/03	109.8	117.0	93.9
456E	(08)	87.0	91.5	95.1
627E		146.0	151.1	96.6
858E		143.7	149.7	96.0
722W		121.3	126.4	96.0
884W		111.6	116.7	95.6
672W		112.5	119.7	94.0
679W		146.6	154.7	94.7
799E	11/09	115.8	124.1	93.3
790E	(08)	124.0	132.6	93.5
486E		123.5	132.6	93.2
602W		126.4	135.0	93.6
893W		109.1	118.0	92.4
798W		0.0	169.2	0.0
899E	11/17	113.9	120.8	94.3
713E	(08)	92.2	96.9	95.1
880E		113.0	118.8	95.1
886W		154.1	162.7	94.7
622W		137.1	145.0	94.6
698W		140.0	146.9	95.3

Table 15a (cont'd)

Weight Balances for Dissected Bluegill

Fish No.	Date of death, 1982 (hr)	Total Wet Weight, gm Sum	Death Weight	Percent
782E	11/20	154.4	160.0	96.5
767E	(08)	163.0	171.3	95.1
728E		154.3	162.7	94.8
715W		155.5	166.0	93.6
889W		161.8	169.5	95.5
606W		190.5	196.5	97.0
477E	11/24	141.2	147.0	96.1
738E	(08)	109.1	115.7	94.3
691E		154.0	160.7	95.8
668W		154.4	161.1	95.8
717W		112.0	118.3	94.7
891W		137.5	143.3	96.0
637E	11/30	141.3	149.0	94.8
721E	(08)	104.3	112.0	93.1
723E		120.5	128.2	94.0
892W		212.4	225.0	94.4
885W		112.9	117.5	96.1
636W		163.8	174.7	93.8
730E	12/07	119.9	125.6	95.5
871E	(08)	119.4	122.8	97.2
705E		140.2	148.4	94.5
641W		101.9	109.2	93.3
615W		144.6	154.1	93.8
735W		106.2	113.2	93.8
694E	12/15	127.5	135.5	94.1
485E	(08)	159.3	166.6	95.6
894E		178.5	184.6	96.7
692W		190.3	201.3	94.5
854W		157.0	163.3	96.1
630W		115.8	121.8	95.0

Table 15b

Weight Balances for Dissected Catfish

Fish No.	Date of death, 1982 (hr)	Total Wet Weight, gm		
		Sum	Death Weight	Percent
351E	08/16	163.5	179.7	91.0
317E	(08)	224.3	240.7	93.2
362E		197.8	209.4	94.5
395W		175.8	186.8	94.1
418W		164.6	179.0	92.0
409W		215.8	231.9	93.1
359E	08/17	181.1	---	---
357E	(08)	222.7	236.5	94.2
300E		207.6	225.5	92.1
421W		202.2	---	---
422W		140.1	155.0	90.4
380W		216.4	235.5	91.9
365E	08/18	134.1	142.3	94.2
361E	(08)	251.8	265.6	94.8
385E		218.7	232.7	94.0
373W		180.2	193.8	93.0
424W		178.5	193.3	92.4
398W		96.1	104.0	92.4
307E	08/24	219.3	237.8	92.2
449E	(08)	248.1	260.7	95.2
276E		149.9	165.1	90.8
372W		244.3	261.4	93.4
401W		233.2	244.9	95.2
416W		216.3	234.1	92.4

Table 15b (cont'd)

Weight Balances for Dissected Catfish

Fish No.	Date of death, 1982 (hr)	Total Wet Weight, gm		
		Sum	Death Weight	Percent
314E	08/26	234.0	250.0	93.6
369E	(08)	231.3	250.0	92.5
332E		208.9	224.0	93.3
448W		159.5	173.0	92.2
439W		302.8	325.0	93.2
389W		254.5	270.0	94.3
355E	09/01	253.9	260.7	97.4
393E	(08)	192.4	208.6	92.2
348E		177.7	181.0	98.2
414W		240.8	256.3	94.0
403W		126.8	134.4	94.3
404W		215.2	226.7	94.9
321E	09/10	194.8	205.8	94.6
363E	(08)	240.4	258.5	93.0
356E		66.5	70.6	94.2
387W		219.3	229.7	95.5
429W		181.3	193.3	93.8
431W		212.8	---	---
428W	09/23	282.2	297.2	95.0
410W	(08)	214.1	223.7	95:7
390W		212.2	225.0	94.3

Table 15c

Weight Balances for Unfed Bluegill & Catfish

Fish No.	Total Wet Weight, gm Sum	Death Weight	Percent
	Bluegill		
683 B	239.7	265.4	90.3
857 B	218.0	239.2	91.1
626 U	184.8	193.5	95.5
628 U	73.0	70.1	104.3
638 U	40.3	42.6	94.7
878 U	180.6	190.5	94.8
	Catfish		
210.1 B	188.0	210.1	89.5
160.4 B	145.4	160.4	90.6
150.7 B	135.4	150.7	89.8
137.0 U	129.6	137.0	94.6
117.4 U	111.7	117.4	95.1
128.0 U	121.7	128.0	95.0

Table 15d

Weight Balances for Worm-fed Bluegill & Catfish

Fish No.	Total Wet Weight, gm Sum	Death Weight	Percent
	Bluegill		
1-1	141.6	149.3	94.8
1-2	103.4	111.0	93.2
1-3	100.4	107.9	93.1
2-1	84.3	88.8	95.0
2-2	84.9	91.2	93.1
2-3	153.5	161.2	95.2
3-1	88.1	91.0	96.8
3-2	93.4	97.6	94.3
3-3	161.4	172.8	93.4
4-1	103.1	110.0	93.8
4-2	82.8	87.8	94.3
4-3	139.7	147.6	94.6
5-1	99.1	111.7	88.8
5-2	114.2	122.0	93.6
5-3	130.5	146.3	89.2
6-1	---	---	---
6-2	68.8	74.3	92.7
6-3	94.3	100.3	94.0
6-4	165.2	169.1	97.7
	Catfish		
7-1	246.2	262.4	93.8
7-2	146.8	152.5	96.2
7-3	151.7	160.6	94.5
8-1	147.2	156.1	94.3
8-2	137.9	147.6	93.4
8-3	151.8	161.2	94.2

Table 15e

Weight Balances for Pellet-fed Bluegill & Catfish

Fish No.	Total Wet Weight, gm Sum	Death Weight	Percent
		Catfish	
1-1	156.0	163.0	95.7
1-2	142.0	148.0	95.9
1-3	143.1	149.6	95.6
3-1	144.2	150.5	95.8
3-2	113.3	118.2	95.8
3-3	134.5	140.8	95.5
4-1	148.5	154.8	96.0
4-2	128.9	134.6	96.2
4-3	157.1	163.2	96.3
5-1	141.0	148.5	94.9
5-2	120.2	126.4	95.1
5-3	134.3	140.0	95.5
7-1	170.6	181.4	94.0
7-2	202.3	212.4	95.2
7-3	171.6	180.0	95.3
8-1	163.3	171.5	95.2
8-2	124.7	133.7	93.0
8-3	139.2	146.3	95.2
		Bluegill	
2-1	83.2	86.5	96.2
2-2	74.8	80.2	93.3
2-3	110.3	115.8	95.3
6-1	71.7	75.6	94.9
6-2	80.1	86.2	93.7
6-3	101.5	105.7	96.0

Table 16

Reproducibility of Phosphate Analysis of Bluegill Muscle

Fish No.	Sample No.	Phosphorus concentration, mg/g wet wt. direct	standard added
892W (11/30)	880	2.72	2.58
		2.74	2.56
		2.70	2.53
		2.71	2.54
		2.69	2.51
		2.73	2.54
		2.69	2.51
		2.66	2.47
Average ± s.d.		2.70 ± 0.03	2.53 ± 0.03

E-26-679

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24 August, 1983

M E M O R A N D U M

To: Paul F. Hayes
Siting and Environmental Branch
Division of Health, Siting and Waste Mangement, USNRC

FROM: Bernd Kahn, Director
Environmental Resources Center

SUBJECT: Bioaccumulation of P-32 in Fish
Quarterly Progress Report for April 1 - June 30, 1983
(NRC No. 04-91-187, GT No. E-26-679)

Stable phosphorus measurements were continued this quarter for all samples accumulated during the study -- fish tissue, feed, water, and material suspended in water. Analytical results for mg phosphorus per gram wet weight or liter solution were combined with P-32 counts/minute per gram or liter to obtain all values as specific activity (P-32 c/min per mg phosphorus). This information is reported here for muscle, skeleton, viscera, suspended solids in water, and some water samples, in the same tables given in earlier quarterly reports for previously available data. The specific activity data are used to compute the biological turnover constant for phosphorus and the ratio of radioactive to stable element bioaccumulation factor for the three types of tissue samples. The weight gain in fish, in terms of grams gained per day per 100 gram average weight, was also calculated. This information was added to tables from earlier reports and used to determine whether the fish experienced normal growth. The next and final quarter of the study will be devoted to performing the remaining phosphorus analyses and writing the completion report.

The weight changes in fish are reported in Tables 5a, 5b, 10, 13a, and 13b. The bluegill in the flowthrough tank averaged a gain of 0.05 and 0.20 percent per day when fed 1.5 and 3.0 g worms per day per 100-g weight respectively. This suggests that the intended regimes of maintenance at the lower portions and moderate growth at higher portions were achieved. That the weight gain for all fish was in a relatively narrow range, between 0.5 and -0.4 percent per day, indicates reasonably uniform feeding and growth patterns. The growth rate constants for individual catfish in the flowthrough tank were more variable, from 1.4 to - 1.5 percent per day, with averages of 0.2 and 0.4 percent per day for respective portions of 1.0 and 2.0 g pellets per day per 100-g weight. Data for the fish fed 1.0 g per day per 100-g weight that were sampled after one day were not used in the calculations because of their large weight loss.

The fish unfed for four days lost weight in 10 of the 12 cases; the large weight gain shown for the first fish in Table 10 is probably due to an error in weighing or recording. The average, omitting this value, was a loss of 0.7 percent per day per 100-g fish for bluegill and catfish combined.

The fish fed in aquaria for 9 days generally lost weight, suggesting that such maintenance was unsatisfactory for a study concerned with mineral uptake. These fish had been acclimated to the tanks for 5 - 7 days before the 9-day period of study began. Another unsatisfactory aspect was the intense territorial dominance exerted by some bluegill as indicated in Tables 13a and 13b on the basis of control over feed and confirmed generally by the large weight gain of dominant fish and large weight loss by the others.

The average phosphorus content of the worms fed to the fish was determined to be 1.23 and 1.15 mg/g wet weight during two experiments (Tables 2 and 12a). The average phosphorus content of the pellets fed to the fish was 13.6 and 13.7 mg/g dry weight during two experiments (Tables 4 and 12b). Analysis of the Purina "Trout Chow L.F." reported by the manufacturer (Table 17a) yields a phosphorus value of 11 mg/g dry weight. The manufacturer's representative informed us that the values in this table are approximations based on the ingredients and refer to 90 percent dry matter. On the basis of our measurements, phosphorus intakes by the bluegill were 1.8 and 3.6 mg per day per 100-g weight by the two bluegill groups, and 13.6 and 27.2 mg per day per 100-g weight for the two catfish groups.

Analyses of the water in the aquaria for the unfed fish yielded phosphorus concentrations of 5.4 mg/L initially and 5.6 and 5.8 mg/L at the end (Table 9). Amounts of NaH_2PO_4 and Na_2HPO_4 were added to the water to obtain an initial concentration of 5.0 mg/L. In addition, a small amount of phosphorus is in the incoming water. The Atlanta Water Treatment Plant adds zinc metaphosphate to the amount of 1 mg/L to reduce pipe corrosion, and phosphate measurements performed by Plant staff during the study period Nov. 1982 - March 1, 1983 were in the range shown in Table 17b. In terms of phosphorus, these analyses indicate a concentration of 0.1 - 0.2 mg/L.

Some checks on the precision of the analytical procedures are available in the 16 samples of catfish muscle that were analyzed in duplicate or triplicate, and further information will become available when 4 duplicate or triplicate samples of catfish head are analyzed (Table 3). For the typical phosphorus concentrations near 2.3 mg/g wet weight, the range of replicate values was between 0.01 and 0.32 mg/g in 14 samples; only in two samples with lower concentrations was the range much worse, possibly due to an erroneous weight measurement. For specific activity, the range of replicates in 14 sets was between 0.1 and 15 percent of the value, and only in two relatively low values were the ranges much higher.

The average ratios of the specific activity in tissue from sets of fish killed at each sampling period relative to the feed are given in Tables 18a-d for fish in the flow-through tanks. These are based on the specific activities in fish tissues -- muscle, skeleton, and viscera are currently available -- listed in Tables 1 and 3, and in feed listed in Tables 2 and 4. The averages do not include data for a few catfish that lost considerable weight during the study. The standard deviation of the mean was estimated to be $0.591 \div (3)^{0.5}$ times the range for 3 values, or one-half the range for 2 values. The ratios are also plotted in Figures 1a-f for bluegill and Figures 2a-c for catfish.

These ratios obtained during the P-32 accumulation period were used, together with the radioactive decay constant of 0.0485 day^{-1} for P-32, to calculate biological turnover rate constants for phosphorus in the various tissues, with the results given in Tables 19a-d. The values are also plotted as curves in Figures 1a-f and 2a-c. The empirical standard deviations of the mean are also given. The utilized equation is in the footnote to Table 19a; because the term for the biological turnover rate constant also appears in the exponent, the solution was obtained by trial and error. Also shown in these tables are the average biological half lives (the natural logarithm of 2 divided by the turnover rate constant) and the ratio of the biological turnover constant to the summed biological turnover and radioactive decay constants. The latter ratio is equal to the ratio of the radioactive to the stable element bioaccumulation factors at equilibrium. The stable element bioaccumulation factor for fish muscle had been estimated to average 70,000.

The ratios of the specific activities obtained for bluegill during the depuration period were used to calculate the total turnover constant -- the sum of the biological turnover constant and the radioactive decay constant for each tissue, as shown in Table 20. The total turnover rate constant is the slope of the dotted line beginning on 11/17 in Figures 1a-f. The solid line in these Figures shows the same total turnover rate constant as obtained from the accumulation period. The biological turnover constant is this value minus 0.0485 day^{-1}.

The average phosphorus biological turnover constants for bluegill, based on the accumulation period, are 0.30 percent per day for feeding slightly above the maintenance level and 0.48 percent per day for feeding twice as much in terms of worm weight per day per 100-gram total weight of fish. The corresponding average equilibrium ratios of radioactive to stable element bioaccumulation factors are 0.058 and 0.090. The phosphorus biological turnover constants for catfish, based on only four or five data points at the beginning of the accumulation period, when the fish were fed pellets that contained much higher daily phosphorus rations, are 0.6 and 1.1 percent per day, where the second value results from twice the amount of pellet feed as the first value. Corresponding average equilibrium ratios of radioactive to stable element bioaccumulation factors are 0.11 and 0.18. Hence, the P-32 bioaccumulation factor for the muscle of bluegills subjected to slightly greater than maintenance feeding (1.8 mg phosphorus per day per 100-g weight) is 70,000 x 0.058 = 4,100. The highest value, for catfish feeding far above maintenance (27 mg phosphorus per day per 100 gram weight) is 70,000 x 0.18 = 13,000. Average annual values for fish feeding ad lib would be expected to be slightly above the lower value.

The depuration-based phosphorus biological turnover constants for bluegill in Table 20 are not considered reliable. They are computed from a small difference between relatively large values and, therefore, are highly uncertain.

A similar set of results was obtained for the skeleton, with phosphorus biological turnover constants that are approximately one-fifth those for muscle. These values are from the accumulation period; values for bluegill from depuration are much higher in one instance and below zero in another, again indicating the large uncertainty of the result.

The pattern of results for bluegill viscera are quite different from muscle and skeleton values. For accumulation, the biological turnover rate constants were generally much higher for the first two weeks than the following five weeks. Depuration was much more rapid, permitting determination of a more reliable turnover rate constant by this procedure. the differences suggest that the viscera samples include more than a single compartment. If this hypothesis is true, then longer observations of depuration would have shown a second turnover rate constant with more gradual slope. Another puzzling aspect is the slightly larger biological turnover rate constant for the fish fed only half as many worms. The average biological turnover constants for catfish based on early accumulation values are consistent with the general trend in being larger than for muscle and skeleton. In view of the differences observed for bluegill in the early and late stages of accumulation, however, these early values can not be considered representative.

The specific activity ratios (tissue/feed) for the 9-day aquarium studies of the effect of type of feed (worms vs. pellets), amount of feed, and water temperatures on P-32 bioaccumulation are summarized in Tables 21a-c. Shown parenthetically for comparison are the values for the ninth day in the flowthrough tank experiments. The general conclusions for muscle and skeleton are that (1) accumulation was much less at 15° C but similar at 20° and 25°; (2) accumulation increased with the amount of phosphorus fed daily at the lower feeding rates; (3) catfish accumulated more than bluegill at the lower feeding rates. Although there was no direct comparison of worms and pellets as feed at the same stable phosphorous content, pellets may have resulted in somewhat larger uptake. As indicated, however, many of the fish in aquaria lost significant amounts of weight and the tissue values of specific activity are suspect for those fish.

The specific activity ratios for the unfed fish maintained in aquaria for a 4-day period in relatively high-phosphate water are summarized in Table 22. These uptakes of dissolved phosphorus by the control fish are about two orders of magnitude below the uptakes by the bluegill fed at just above maintenance level. The uptake of phosphorus by fish with an unblocked esophagus, if it consumed 4 ml water/day, would have been 0.02 mg phosphorus/day, also two orders of magnitude below the intake by fed fish. Muscle and skeleton levels are similar for the two species. In most tissues, the fish with blocked esophagus, however, had twice the specific activity levels of the control fish.

Completion of all phosphorus analyses will be attempted next quarter. This information will be needed to analyze the remaining tissues in the same manner as muscle, skeleton, and viscera, and also to obtain total phosphorus contents in fish. The latter can be used to relate total fish analyses to muscle analyses.

The following students participated in this study during the quarter:

Name	Department	Fraction of Time
David Martini, GRA	Biology	1/3
Robert Hammond, GRA	Nuclear Eng./Health Phys.	1/3

Other participants were Dr. Rifaat El-Shinawy (IAEA Fellow), Marcia Wilson, and Kristin Turgeon.

Table 1
P-32 Uptake and Depuration in Bluegill
Muscle

Fish No.(1)	Date of death, 1982 (hr)	Weight,(2) wet	dry	ashed	Sample No.
761E	09/28	22.5	4.10	277	285
794E	(08)	23.1	3.48	307	326
879E		34.3	6.23	398	314
499W		16.3	2.42	169	315
708W		30.7	5.53	403	334
787W		29.1	5.75	347	325
684E	09/29	42.3	7.74	470	452
859E	(08)	31.8	--	333	443
863E		20.9	4.33	254	457
608W		27.1	5.67	334	458
682W		39.1	7.47	424	444
890W		33.8	6.50	394	571
619E	09/30	37.3	6.54	401	503
872E	(08)	39.2	7.52	474	420
635E		38.0	7.46	468	433
706W		29.2	5.38	347	451
704W		32.4	6.61	405	454
480W		45.9	9.80	610	415
759E	10/06	24.3	3.85	118(6)	532
674E	(08)	20.1	4.05	266	584
762E		28.6	5.94	339	459
613W		33.4	7.25	417	460
680W		22.2	4.73	256	466
792W		32.1	7.12	396	549
699E	10/12	29.9	5.31	357	597
784E	(08)	35.7	6.88	455	494
733E		21.0	3.59	228	475
488W		34.2	6.90	398	518
490W		23.0	4.72	302	586
476W		40.0	8.00	497	523

(1) W fish received twice as much feed as E fish, at same specific activity (2) Wet and dry weight in gram; ashed weight in mg. (3) Duplicate 20-ml aliquots of 100-ml samples were analyzed for P-32 by Cherenkov counting with 50-min counts when < 200 c/min and 10-min counts when > 200 c/min (4) Tail samples were combined with skeleton samples after 10/19 (5) Month 01 is in 1983 (6) Weight appears to be erroneous (7) Average of 2 or more measurements

Table 1
P-32 Uptake and Depuration in Bluegill
Muscle

Fish No.(1)	Date of counting, 1982 (hr)	P-32 decay fraction	net c/min.(3)	c/min.g. wet	P, mg/g	P-32/P, c/min.mg.
761E	10/12(18)	0.498	33.0	14.7	2.31	6.4
794E	10/15(05)	0.441	10.6	5.2	2.43	2.1
879E	10/14(21)	0.447	22.5	7.3	2.31	3.2
499W	10/14(23)	0.447	120	82.3	1.93(7)	42.6
708W	10/19(10)	0.360	136	61.5	2.60	23.7
787W	10/14(12)	0.456	231	87.0	2.42	36.0
684E	11/02(18)	0.189	69.2	43.3	2.16(7)	20.0
859E	11/02(17)	0.189	137.	114	2.14(7)	53.3
863E	11/03(01)	0.186	54.4	70.0	2.27	30.8
608W	11/04(14)	0.173	183.	195	2.28	85.5
682W	11/03(11)	0.182	231.	162	2.16(7)	75.0
890W	11/09(13)	0.136	233	243	3.01	80.7
619E	11/05(19)	0.170	28.0	22.1	2.03	11.1
872E	10/25(20)	0.291	248	109	2.43	44.9
635E	10/26(01)	0.288	381	174	2.25	77.3
706W	11/03(14)	0.191	204	183	2.63	69.6
704W	11/03(14)	0.191	192	155	2.49	62.3
480W	10/25(18)	0.292	429	160	2.41	66.4
759E	11/06(18)	0.218	259	244	1.86(7)	131
674E	11/09(15)	0.190	306	401	2.05	196
762E	11/03(15)	0.254	514	354	1.85	191
613W	11/03(15)	0.254	646	381	2.32	164
680W	11/04(11)	0.244	528	487	2.53	193
792W	11/07(22)	0.206	770	582	2.57	227
699E	11/10(12)	0.243	1,167	803	2.28	352
784E	11/04(17)	0.322	2,048	891	2.27	393
733E	11/04(14)	0.325	500	366	2.09	175
488W	11/04(22)	0.319	1,957	897	1.99	451
490W	11/09(16)	0.253	766	658	2.66(7)	247
476W	11/04(22)	0.319	948	371	2.45	151

Table 1 cont'd
P-32 Uptake and Depuration in Bluegill
Muscle

Fish No.	Date of death, 1982 (hr)	Weight, wet	dry	ashed	Sample No.
769E	10/19	28.4	6.01	351	613
482E	(08)	25.4	5.38	301	617
677E		21.9	2.79	198	556
497W		23.4	4.96	287	555
873W		40.2	8.35	416	624
607W		39.8	8.00	478	627
876E	10/26	29.4	5.67	332	673
763E	(08)	26.8	5.33	331	654
881E		23.6	5.07	300	695
785W		33.2	7.05	422	651
716W		33.3	7.23	427	647
875W		40.4	8.90	528	646
882E	11/03	22.8	4.37	268	703
456E	(08)	24.1	5.20	298	701
627E		34.7	6.97	448	795
858E		38.4	7.86	471	698
722E		36.4	7.68	434	702
884W		34.5	7.21	435	705
672W		25.0	4.53	301	670
679W		34.3	6.51	430	685
799E	11/09	28.2	5.51	374	717
790E	(08)	41.3	8.91	539	719
486E		23.7	4.04	274	715
602W		38.1	8.06	489	785
893W		19.5	3.47	267	790
798W		43.3	8.74	572	718
899E	11/17	23.3	4.58	301	763
713E	(08)	31.2	6.63	412	766
880E		28.4	5.49	360	765
886W		29.8	5.96	379	759
622W		41.4	8.63	536	757
698W		37.4	7.29	467	826

Table 1 cont'd
P-32 Uptake and Depuration in Bluegill
Muscle

Fish No.	P-32 Date of counting, 1982 (hr)	decay fraction	net c/min	c/min.g. wet	P, mg/g	P-32/P, c/min.mg.
769E	11/17(11)	0.244	1,044	753	2.35	320
482E	11/17(13)	0.243	735	595	1.96	304
677E	11/08(08)	0.379	724	436	1.51	289
497W	11/08(08)	0.379	1,640	925	2.56	361
873W	11/17(14)	0.243	2,770	1,418	2.62	541
607W	11/17(15)	0.243	1,770	915	2.64	347
876E	11/23(13)	0.255	1,121	748	2.18	343
763E	11/23(11)	0.255	1,118	818	2.34	350
881E	11/24(06)	0.246	177	152	2.63	57.8
785W	11/23(10)	0.256	1,592	937	2.39	392
716W	11/18(14)	0.325	2,660	1,229	1.97	624
875W	11/18(14)	0.325	2,450	933	2.64	353
882E	11/24(22)	0.351	1,200	750	2.46	305
456E	11/24(18)	0.354	1,095	642	2.59	248
627E	12/10(11)	0.166	1,427	1,239	2.65	468
858E	11/24(16)	0.356	1,569	574	2.65	217
722E	11/24(20)	0.352	1,452	567	2.28	249
884W	11/25(01)	0.349	1,939	805	2.47	326
672W	11/23(12)	0.375	765	408	2.26	181
679W	11/24(13)	0.358	2,438	993	2.30	406
799E	11/25(21)	0.448	2,213	875	2.45	357
790E	11/26(01)	0.444	2,355	642	2.50	257
486E	11/25(18)	0.451	689	323	2.14(7)	151
602W	12/03(14)	0.308	1,334	568	2.36	241
893W	12/10(10)	0.221	1,155	1,342	2.50	537
798W	11/25(01)	0.466	5,069	1,256	2.61	481
899E	12/02(15)	0.477	1,971	887	2.44	364
713E	12/02(16)	0.476	2,293	772	2.35	329
880E	12/02(16)	0.476	1,240	459	2.33	197
886W	12/02(14)	0.477	3,781	1,330	2.34	568
622W	12/02(13)	0.477	3,515	890	2.44	365
698W	12/10(24)	0.317	2,024	854	2.38(7)	359

Table 1 cont'd
P-32 Uptake and Depuration in Bluegill
Muscle

Fish No.	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.
782E	11/20	34.6	7.31	444	846
767E	(08)	48.7	10.52	582	849
728E		46.7	10.41	592	848
715W		47.7	10.71	605	931
889W		44.5	10.11	596	1017
606W		43.2	9.64	548	847
477E	11/24	39.4	8.26	483	876
738E	(08)	31.3	6.39	431	845
691E		49.0	10.37	640	881
668W		34.1	7.40	438	878
717W		22.9	5.00	325	932
891W		43.5	9.12	583	868
637E	11/30	37.0	7.52	450	853
721E	(08)	24.7	4.88	316	852
723E		31.5	6.25	385	885
892W		56.5	12.12	720	880
885W		31.7	7.02	406	877
636W		52.2	11.10	670	851
730E	12/07	38.7	8.04	478	898
871E	(08)	32.7	6.64	377	897
705E		30.4	5.41	367	896
641W		34.9	7.30	456	900
615W		45.6	8.62	527	895
735W		32.1	6.71	404	901
694E	12/15	24.7	4.44	373	1088
485E	(08)	38.4	7.36	498	1025
894E		54.1	11.22	716	1089
692W		55.0	11.54	677	998
854W		57.0	12.62	748	1090
630W		35.6	7.63	472	1091

Table 1 cont'd
P-32 Uptake and Depuration in Bluegill
Muscle

	P-32					
Fish No.	Date of counting, 1982(hr)(5)	decay fraction	net c/min	c/min.g. wet	P, mg/g	P-32/P, c/min.mg.
782E	12/12(22)	0.334	1,646	712	2.34	304
767E	12/16(10)	0.282	1,406	512	2.47	207
728E	12/13(01)	0.333	4,081	1,312	1.97(7)	666
715W	12/22(10)	0.211	1,454	722	2.73(7)	265
889W	12/31(24)	0.133	1,283	1,084	2.66	408
606W	12/12(23)	0.334	1,762	611	1.98(7)	309
477E	12/16(20)	0.336	1,671	631	2.54	248
738E	12/12(20)	0.408	3,101	1,214	3.62(7)	335
691E	12/16(22)	0.335	2,467	751	2.41	312
668W	12/16(21)	0.336	1,856	810	2.50	324
717W	12/22(10)	0.256	1,372	1,170	2.72	430
891W	12/16(17)	0.338	1,872	637	2.50	255
637E	12/16(11)	0.458	1,785	527	2.52	209
721E	12/16(11)	0.458	854	377	2.54	148
723E	12/16(23)	0.446	1,291	459	2.55	180
892W	12/16(21)	0.449	4,748	935	2.58	362
885W	12/16(20)	0.449	2,101	738	2.64	280
636W	12/16(11)	0.458	3,010	630	2.74	230
730E	12/18(03)	0.593	1,670	364	2.65	137
871E	12/18(01)	0.595	652	168	2.33	72.1
705E	12/17(23)	0.598	720	198	2.45	80.8
641W	12/18(09)	0.586	1,664	407	2.63	155
615W	12/17(22)	0.599	1,919	349	2.33	150
735W	12/17(08)	0.616	1,556	393	2.54	155
694E	01/14(15)	0.230	236	208	2.44	85.2
485E	01/01(14)	0.434	784	235	2.62	89.7
894E	01/14(15)	0.230	634	255	2.61	97.7
692W	12/30(16)	0.476	1,921	367	2.51	146
854W	01/14(15)	0.230	643	245	2.72	90.1
630W	01/14(16)	0.230	353	216	2.50	86.4

Table 1 cont'd
P-32 Uptake and Depuration in Bluegill
Skeleton

Fish No.(1)	Date of death, 1982 (hr)	Weight, wet	dry	ashed	Sample No.
761E	09/28	22.4	6.79	2,470	371
794E	(08)	23.9	6.84	3,300	310
879E		30.0	9.10	2,990	328
499W		23.6	6.79	2,870	329
708W		24.3	6.59	2,580	327
787W		29.7	8.49	2,780	335
684E	09/29	32.0	9.39	3,370	418
859E	(08)	28.5	8.85	3,230	469
863E		20.8	6.31	1,540	468
608W		21.7	6.79	2,020	467
682W		33.7	10.12	2,540	416
890W		29.6	8.52	---	484
619E	09/30	14.6	--	2,210	453
872E	(08)	27.0	8.81	3.010	417
635E		25.1	8.13	2,630	409
706W		21.4	6.60	2,650	419
704W		19.1	6.84	1,910	398
480W		25.1	9.20	3,070	473
759E	10/06	24.0	6.22	2,260	572
674E	(08)	22.1	6.82	2,380	491
762E		26.2	8.27	2,570	471
613W		20.9	6.52	1,740	598
680W		16.2	5.20	1,390	449
792W		22.9	7.48	1,700	567
699E	10/12	33.9	9.01	3,400	566
784E	(08)	32.8	9.35	2,920	541
733E		22.5	5.59	2,390	447
488W		20.9	6.70	1,710	564
490W		19.2	5.83	1,880	548
476W		30.4	8.64	3,140	596

Table 1 cont'd
P-32 Uptake and Depuration in Bluegill
Skeleton

	P-32					
Fish No.(1)	Date of counting, 1982 (hr)	decay fraction	net c/min.	c/min.g. wet	P, mg/g	P-32/P, c/min.mg.
761E	10/20(22)	0.334	89.3	59.7	17.6	3.39
794E	10/14(06)	0.463	34.7	15.7	24.1	0.651
879E	10/15(07)	0.439	34.9	13.2	17.5	0.754
499W	10/15(11)	0.439	302	146	19.9	7.34
708W	10/14(13)	0.456	191	86.2	20.3	4.25
787W	10/19(11)	0.360	338	158	15.8	10.0
684E	10/25(19)	0.264	160	94.7	20.0	4.74
859E	11/04(12)	0.173	222	225	20.6	10.9
863E	11/03(16)	0.184	120	157	13.9	11.3
608W	11/04(12)	0.173	212	282	16.3	17.3
682W	10/25(19)	0.264	491	276	14.3	19.3
890W	11/04(14)	0.173	329	321	16.2	19.8
619E	11/02(20)	0.197	31.4	54.6	22.4	2.44
872E	10/25(19)	0.291	390	248	21.4	11.6
635E	10/25(16)	0.293	419	285	21.0	13.6
706W	10/25(20)	0.291	306	246	20.4	12.1
704W	10/25(15)	0.294	309	275	17.7	15.5
480W	11/04(13)	0.182	232	254	23.8	10.7
759E	11/09(13)	0.191	280	305	16.8	18.2
674E	11/04(16)	0.242	520	486	18.9	25.7
762E	11/04(12)	0.243	529	415	17.5	23.7
613W	11/10(12)	0.182	560	736	15.1	48.7
680W	11/03(13)	0.255	743	899	15.6	57.6
792W	11/10(10)	0.183	614	733	15.8	46.4
699E	11/09(12)	0.255	1,054	610	18.1	33.7
784E	11/07(09)	0.283	1,720	926	14.3	64.8
733E	11/03(12)	0.341	506	330	16.3	20.2
488W	11/09(11)	0.255	1,399	1,313	16.4	80.1
490W	11/07(21)	0.277	672	632	12.7	49.8
476W	11/10(11)	0.244	726	489	18.4	26.6

Table 1 cont'd
P-32 Uptake and Depuration in Bluegill
Skeleton

Fish No.	Date of death, 1982 (hr)	Weight, wet	dry	ashed	Sample No.
782E	11/20	37.5	10.08	3,130	858
767E	(08)	33.8	10.18	3,100	1013
728E		34.1	10.26	3,290	1016
715W		31.1	10.26	3,090	832
889W		40.0	12.00	3,480	834
606W		52.8	14.51	3,990	857
477E	11/24	30.8	9.68	2,860	875
738E	(08)	23.0	7.38	2,870	856
691E		29.7	9.52	3,160	936
668W		37.7	11.59	3,640	855
717W		26.7	8.41	2,740	864
891W		26.0	8.18	2,830	907
637E	11/30	30.7	9.25	2,930	1043
721E	(08)	24.0	7.68	2,890	866
723E		25.4	7.93	2,650	862
892W		45.2	14.97	4,300	867
885W		20.9	6.65	1,460	939
636W		30.5	10.21	3,440	1035
730E	12/07	26.0	7.97	2,420	1006
871E	(08)	26.1	7.77	2,210	966
705E		30.0	8.98	3,570	987
641W		21.4	6.64	1,840	1000
615W		28.1	8.54	3,160	979
735W		27.3	8.31	1,960	1002
694E	12/15	26.1	7.38	3,140	1083
485E	(08)	33.1	10.08	3,890	1026
894E		37.4	11.21	3,550	992
692W		39.1	12.26	3,700	1030
854W		28.3	9.67	2,490	993
630W		26.0	8.11	1,660	1102

Table 1 cont'd
P-32 Uptake and Depuration in Bluegill
Skeleton

	P-32					
Fish No.	Date of counting, 1982 (hr)	decay fraction	net c/min	c/min.g. wet	P, mg/ml	P-32/P, c/min.mg.
782E	12/16(13)	0.281	1,443	685	15.7	41.0
767E	12/31(18)	0.134	654	722	19.7	36.6
728E	12/31(23)	0.133	1,038	1,144	16.8	68.1
715W	12/11(22)	0.351	1,850	847	17.7	47.9
889W	12/12(02)	0.348	3,993	1,434	16.7	85.9
606W	12/16(13)	0.281	3,028	1,020	15.3	66.6
477E	12/16(20)	0.336	1,419	686	17.0	40.4
738E	12/16(12)	0.341	989	630	23.3	27.0
691E	12/22(12)	0.255	1,374	907	21.7	41.8
668W	12/16(12)	0.341	1,809	704	21.1	33.4
717W	12/16(15)	0.339	2,037	1,125	18.8	59.8
891W	12/18(18)	0.306	1,076	676	19.1	35.4
637E	01/07(12)	0.157	535	555	22.0	25.2
721E	12/16(16)	0.452	677	312	22.2	14.1
723E	12/16(14)	0.456	1,040	449	17.6	25.5
892W	12/16(17)	0.452	4,706	1,152	16.1	71.6
885W	12/22(12)	0.341	1,673	1,175	12.4	94.8
636W	01/02(06)	0.213	1,025	788	19.1	41.3
730E	12/31(06)	0.314	826	506	14.4	35.1
871E	12/23(10)	0.459	523	218	15.0	14.5
705E	12/23(13)	0.456	444	162	19.2	8.44
641W	12/30(20)	0.320	789	576	15.3	37.6
615W	12/23(12)	0.457	875	341	19.9	17.1
735W	12/30(24)	0.318	1,170	674	14.4	46.8
694E	01/07(15)	0.323	299	177	21.3	8.31
485E	01/01(16)	0.432	600	210	24.3	8.64
894E	12/30(07)	0.484	907	251	18.8	13.4
692W	01/01(22)	0.426	1,089	327	17.7	18 5
854W	12/30(08)	0.483	1,069	391	16.1	24.3
630W	01/14(18)	0.229	337	283	12.1	23.4

Table 1 cont'd
P-32 Uptake and Depuration in Bluegill
Skeleton

Fish No.	Date of death, 1982 (hr)	Weight, wet	dry	ashed	Sample No.
769E	10/19	23.2	7.15	1,970	554
482E	(08)	21.4	6.66	1,590	562
677E		19.9	5.50	2,620	594
497W		18.7	5.39	1,290	553
873W		36.9	10.36	2,860	561
607W		39.7	11.81	3,720	592
876E	10/26	22.4	7.00	2,060	683
763E	(08)	27.5	9.00	3,640	773
881E		18.1	5.62	1,650	743
785W		30.8	9.37	3,020	687
716W		34.9	10.56	3,390	688
875W		33.0	10.38	3,320	749
882E	11/03	23.7	7.00	2,630	788
456E	(08)	22.7	7.12	1,730	770
627E		33.5	9.83	3,420	787
858E		32.3	9.93	2,680	678
722E		28.1	8.98	2,050	786
884W		25.6	8.05	4,210	771
672W		24.0	6.96	2,890	747
679W		34.1	10.31	4,080	793
799E	11/09	24.3	7.36	2,630	730
790E	(08)	24.5	8.47	2,090	724
486E		26.4	8.07	3,280	767
602W		27.8	9.47	2,300	731
893W		24.2	8.32	3,750	768
798W		35.2	11.03	3,450	733
899E	11/17	29.7	8.31	2,810	822
713E	(08)	18.7	6.02	1,610	824
880E		25.4	7.64	2,860	817
886W		31.9	9.26	3,000	828
622W		30.6	9.06	2,520	835
698W		31.0	9.07	3,200	816

Table I cont'd
P-32 Uptake and Depuration in Bluegill
Skeleton

Fish No.	Date of counting, 1982 (hr)	P-32 decay fraction	net c/min	c/min.g. wet	P, mg/g	P-32/P, c/min.mg.
769E	11/08(07)	0.380	1,539	873	14.0	62.4
482E	11/09(10)	0.360	1,119	726	12.9	56.3
677E	11/10(11)	0.343	806	590	23.7	24.9
497W	11/08(05)	0.382	1,645	1,151	13.5	85.3
873W	11/09(10)	0.360	3,675	1,383	13.7	100.9
607W	11/09(16)	0.356	2,444	865	13.9	62.2
876E	11/23(16)	0.254	1,207	1,061	16.3	65.1
763E	12/03(11)	0.158	811	933	26.8	34.8
881E	12/02(11)	0.165	194	325	17.5	18.6
785W	11/24(14)	0.243	1,449	968	17.3	56.0
716W	11/24(14)	0.243	1,981	1,168	17.9	65.3
875W	12/02(12)	0.165	1,196	1,098	18.4	59.6
882E	12/10(09)	0.166	689	876	20.4	42.9
456E	12/03(10)	0.232	1,211	1,150	14.0	82.1
627E	12/10(09)	0.166	1,295	1,164	18.0	64.7
858E	11/23(15)	0.374	1,855	768	14.6	52.6
722E	12/10(08)	0.166	802	860	12.5	68.8
884W	12/03(11)	0.232	1,326	1,116	14.3	78.0
672W	12/02(12)	0.243	633	543	20.5	26.5
679W	12/10(11)	0.166	1,131	1,002	21.3	47.0
799E	11/26(18)	0.430	2,023	968	20.0	48.4
790E	11/26(09)	0.438	2,414	1,126	16.2	69.5
486E	12/03(09)	0.310	643	393	20.1	20.0
602W	11/26(20)	0.427	1,765	743	15.2	48.8
893W	12/03(10)	0.310	1,462	974	29.7	32.8
798W	11/26(23)	0.425	3,807	1,272	20.2	63.0
899E	12/10(17)	0.322	2,013	1,052	18.2	57.8
713E	12/10(21)	0.320	1,679	1,403	17.3	81.1
880E	12/10(15)	0.323	1,002	611	21.1	29.0
886W	12/11(16)	0.308	3,197	1,627	18.8	86.5
622W	12/12(04)	0.299	2,802	1,531	15.0	102.0
698W	12/10(14)	0.323	2,083	1,040	19.0	54.7

Table I cont'd
P-32 Uptake and Depuration in Bluegill
Viscera

Fish No.(1)	Date of death, 1982 (hr)	Weight, wet	dry	ashed	Sample No.
761E	09/28	8.4	1.20	104	305
794E	(08)	6.6	1.08	128(6)	288
879E		11.2	2.54	136	343
499W		10.5	1.33	113	301
708W		10.9	1.55	119	298
787W		16.3	3.56	201	320
684E	09/29	8.6	1.55	101	410
859E	(08)	13.4	1.80	126	374
863E		5.7	0.97	60.0	406
608W		7.2	1.30	68.9	377
682W		9.4	2.60	82.8	368
890W		11.3	1.61	110	405
619E	09/30	6.4	1.34	67.2	403
872E	(08)	11.1	1.79	128	381
635E		11.5	1.75	140	375
706W		12.1	1.71	118	404
704W		10.0	3.13	88.7	380
480W		12.0	2.42	116	369
759E	10/06	5.0	0.83	69.4	465
674E	(08)	7.9	1.15	90.2	462
762E		6.7	1.30	86.9	606
613W		5.6	0.72	---	602
680W		4.6	1.10	55.4	485
792W		7.2	2.64	76.1	488
699E	10/12	8.7	1.50	126	510
784E	(08)	8.9	1.68	105	577
733E		4.3	0.65	57.2	516
488W		5.9	1.93	63.3	580
490W		7.0	1.35	73.6	513
476W		11.4	1.61	146	537

Table 1 cont'd
P-32 Uptake and Depuration in Bluegill
Viscera

Fish No.(1)	P-32: Date of counting, 1982 (hr)	decay fraction	net c/m(2)	c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg.
761E	10/13(13)	0.481	747	92.4	2.08	44.4
794E	10/12(22)	0.493	66.2	102	2.37	43.0
879E	10/20(00)	0.349	95.6	122	2.28	53.5
499W	10/13(12)	0.481	2,515	2,490	1.61	1,546
708W	10/13(10)	0.481	3,119	2,970	1.77	1,677
787W	10/14(11)	0.458	1,855	1,242	2.46	504
684E	10/25(17)	0.279	377	786	1.99	395
859E	10/21(13)	0.341	1,518	1,650	1.42	1,162
863E	10/25(16)	0.279	253	795	1.77	449
608W	10/21(14)	0.341	783	1,595	1.62	985
682W	10/21(13)	0.341	1,071	1,671	1.44	1,160
890W	10/25(16)	0.279	1,374	2,180	1.67	1,305
619E	10/21(11)	0.360	84.6	184	2.18	84.4
872E	10/25(12)	0.295	1,596	2,440	1.68	1,452
635E	10/21(14)	0.358	2,046	2,480	2.42	1,025
706W	10/25(16)	0.293	2,390	3,370	1.68	2,006
704W	10/25(11)	0.295	1,623	2,750	1.34	2,050
480W	10/21(13)	0.358	3,077	3,580	1.54	2,320
759E	11/03(16)	0.253	1,040	4,110	2.12	1,939
674E	11/03(16)	0.253	1,392	3,480	1.78	1,955
762E	11/17(11)	0.130	458	2,630	2.60	1,012
613W	11/10(13)	0.182	770	3,780	2.22	1,702
680W	11/04(14)	0.242	1,023	4,600	2.14	2,150
792W	11/04(14)	0.242	1,485	4,260	1.93	2,210
699E	11/04(20)	0.322	1,570	2,800	2.87	976
784E	11/09(14)	0.254	1,198	2,650	2.19	1,210
733E	11/04(21)	0.322	496	1,791	2.14	837
488W	11/09(14)	0.254	925	3,090	2.07	1,493
490W	11/04(21)	0.322	1,388	3,080	1.91	1,613
476W	11/07(02)	0.287	1,590	2,430	1.51	1,609

Table 1 cont'd
P-32 Uptake and Depuration in Bluegill
Viscera

Fish No.	Date of death, 1982 (hr)	Weight, wet	dry	ashed	Sample No.
769E	10/19	6.3	1.41	71.4	615
482E	(08)	5.3	1.63	53.1	614
677E		6.2	0.85	84.6	625
497W		6.5	1.32	74.6	610
873W		12.1	2.17	151	622
607W		14.4	2.30	162	605
876E	10/26	7.0	1.53	85.5	692
763E	(08)	11.7	1.85	158	699
881E		3.9	0.84	44.9	700
785W		11.7	1.98	138	713
716W		11.1	1.98	127	640
875W		9.2	1.92	114	638
882E	11/03	8.1	1.30	86.3	779
456E	(08)	4.0	0.95	32.9	775
627E		8.0	1.49	118	804
858E		8.0	2.19	68.5	780
722E		7.3	2.25	56.3	736
884W		6.4	1.53	77.8	796
672W		8.8	1.16	85.9	776
679W		9.0	1.65	114	778
799E	11/09	6.8	1.29	74.5	806
790E	(08)	7.3	2.67	58.2	805
486E		6.4	1.03	64.6	761
602W		7.5	3.61(´)	55.2	762
893W		6.3	1.09	64.9	812
798W		9.3	2.12	107	807
899E	11/17	6.9	1.31	79.4	818
713E	(08)	5.5	1.18	56.3	821
880E		7.1	1.37	104	1019
886W		14.7	2.49	154	1018
622W		10.6	2.23	108	815
698W		9.0	1.73	110	1020

Table 1 cont'd
P-32 Uptake and Depuration in Bluegill
Viscera

Fish No.	Date of counting, 1982 (hr)	P-32 decay fraction	net c/min	c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg.
769E	11/17(12)	0.243	596	1,947	2.27	858
	/17(12)	0.243	385	1,485	1.76	844
	/17(14)	0.242	294	980	2.28	430
497W	11/17(11)	0.243	695	2,200	1.81	1,215
873W	11/17(14)	0.242	1,418	2,420	2.01	1,204
607W	11/10(13)	0.341	2,256	2,300	1.90	1,211
876E	11/24(15)	0.242	1,213	3,580	2.42	1,479
763E	11/24(16)	0.242	1,468	2,590	2.55	1,016
881E	11/24(16)	0.242	240	1,271	2.45	519
785W	11/25(14)	0.231	1,428	2,640	2.25	1,173
716W	11/18(13)	0.325	1,847	2,560	2.13	1,202
875W	11/18(12)	0.325	1,905	3,180	2.22	1,432
882E	12/03(13)	0.231	1,187	3,170	2.06	1,539
456E	12/03(12)	0.231	348	1,833	2.06	890
627E	12/10(12)	0.165	679	2,570	2.86	899
858E	12/03(13)	0.231	799	2,160	1.60	1,350
722E	12/02(10)	0.243	305	860	0.62(6)	1,387
884W	12/10(11)	0.165	626	2,960	2.19	1,352
672W	12/03(12)	0.231	814	2,000	1.99	1,005
679W	12/03(13)	0.231	1,456	3,500	2.70	1,296
799E	12/10(13)	0.220	907	3,040	2.57	1,183
790E	12/10(13)	0.220	608	1,895	1.80	1,053
486E	12/02(15)	0.323	645	1,543	1.96	787
602W	12/02(15)	0.323	614	1,268	1.61	788
893W	12/10(14)	0.220	853	3,080	2.15	1,433
798W	12/10(13)	0.220	1,144	2,800	2.63	1,065
899E	12/12(15)	0.293	1,414	3,500	2.55	1,373
713E	12/12(16)	0.293	976	3,030	1.87	1,620
880E	01/01(02)	0.114	269	1,662	3.21	518
886W	01/01(01)	0.115	851	2,520	2.05	1,229
622W	12/10(14)	0.324	3,042	2,970	2.00	1,485
698W	01/01(04)	0.114	573	2,790	2.55	1,094

Table I cont'd
P-32 Uptake and Depuration in Bluegill
Viscera

Fish No.	Date of death, 1982 (hr)	Weight, wet	dry	ashed	Sample No.
782E	11/20	8.7	1.62	95.6	947
767E	(08)	8.6	2.08	92.3	882
728E		8.1	1.74	73.5	948
715W		8.4	1.94	87.9	1022
889W		8.1	1.88	101.5	954
606W		8.7	2.30	81.8	953
477E	11/24	7.8	2.04	83.7	1031
738E	(08)	6.0	1.16	74.6	1041
691E		9.6	2.03	107.5	1040
668W		9.1	1.78	97.0	943
717W		5.8	1.30	70.8	942
891W		8.1	1.68	94.5	1032
637E	11/30	8.7	1.58	89.5	962
721E	(08)	5.1	0.90	61.4	892
723E		6.1	1.17	70.6	890
892W		16.2	4.19	179.1	964
885W		5.3	1.89	46.5	961
636W		12.4	2.24	125	963
730E	12/07	5.0	1.21	56.5	910
871E	(08)	6.7	1.63	78.0	984
705E		9.1	1.51	107.0	981
641W		5.7	1.39	63.8	982
615W		8.6	1.36	88.0	972
735W		5.2	1.22	49.7	983
694E	12/15	12.0	1.64	144.0	997
485E	(08)	11.3	1.93	135.0	999
894E		13.8	2.84	187.0	1024
692W		13.9	2.96	148.0	1080
854W		9.6	3.02	94.5	1023
630W		7.6	2.66	69.4	989

Table 1 cont'd
P-32 Uptake and Depuration in Bluegill
Viscera

Fish No.	Date of counting, 1982 (hr)	decay fraction	net c/min	c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg.
	P-32					
782E	12/22(13)	0.210	639	1,749	2.58	678
767E	12/16(22)	0.275	668	1,412	2.19	645
728E	12/22(13)	0.210	629	1,849	2.35	786
715W	01/01(09)	0.131	391	1,777	2.32	766
889W	12/22(14)	0.209	578	1,707	2.87	595
606W	12/22(14)	0.209	665	1,829	2.16	847
477E	01/01(24)	0.153	284	1,190	2.34	509
738E	01/07(11)	0.118	172	1,215	2.43	500
691E	01/07(11)	0.118	283	1,249	2.61	479
668W	12/22(13)	0.255	641	1,381	2.59	533
717W	12/22(12)	0.255	548	1,853	3.04	610
891W	01/02(02)	0.153	362	1,461	2.68	545
637E	12/22(16)	0.339	397	673	2.55	264
721E	12/16(06)	0.461	285	605	3.00	202
723E	12/16(23)	0.469	400	735	3.02	243
892W	12/23(10)	0.326	896	847	2.77	306
885W	12/22(15)	0.339	243	677	2.03	333
636W	12/23(09)	0.326	607	750	2.34	321
730E	12/18(21)	0.573	272	475	2.66	179
871E	12/25(01)	0.424	151	266	2.52	106
705E	12/24(22)	0.426	205	264	2.37	111
641W	12/23(13)	0.456	234	450	2.84	158
615W	12/23(11)	0.458	373	473	2.77	171
735W	12/24(24)	0.424	192	435	2.31	188
694E	12/30(15)	0.476	162	142	2.23	63.7
485E	12/30(18)	0.474	183	171	2.37	72.2
894E	01/01(12)	0.435	180	150	2.69	55.8
692W	01/07(15)	0.323	190	211	2.37	89.0
854W	01/01(10)	0.437	158	188	2.08	90.4
630W	12/30(02)	0.489	112	151	2.13	70.9

Table 2
Bluegill Food

Date of feeding, 1982	Vial No.	Weight, mg. Dry	Ash	amt. fed, g E	W	Number of fish E	W
09/27	536	595	---	104.	204	55	51
28	504	144	---	99.3	196.3	52	48
29			---	93.9	185.5	49	45
30	529	160	---	88.5	174.7	46	42
10/01			---	10.0	32.0	46	42
02			---	88.5	104.5	46	42
03	507		16.8	88.5	174.7	46	41
04				88.5	174.7	46	41
05	442		---	78.0	120.2	46	41
06	505		9.4	65.2	92.3	43	38
07	506		12.9	78.1	128.	43	38
08	530		14.1	78.2	163.	43	38
09	527		17.6	78.4	112.5	43	38
10	535		14.6	78.3	172.	43	38
11	534		17.6	78.2	71.0	43	38
12	528		13.8	83.1	145.3	40	35
13				75.3	65.1	40	35
14		feed not eaten		0.0	0.0	40	35
15	1111	301	21.2	83.2	129.5	40	34
16	1112	355	24.5	95.1	125.5	40	34
17	1113	233	18.2	83.2	110.5	40	34
18	1114	305	21.2	83.5	150.2	40	34
19	1115	332	21.4	65.2	125.4	37	31
20	1116	254	18.4	65.5	155.2	37	31
21	1117	320	20.8	55.2	45.4	37	31
22	1118	311	21.2	52.5	75.3	37	31
23	1119	304	17.5	85.2	125.6	37	31
24	1120	292	18.6	90.1	120.5	37	31
25	1121	295	17.3	90.0	85.0	37	31
26	1122	252	16.3	75.2	84.3	34	28
27	1123	273	15.2	65.3	65.7	34	28
	1124	300	17.2				
28	1125	321	17.2	50.3	61.5	34	28
29	1126	288	15.8	60.3	120.5	34	28
30	1127	264	14.7	90.2	155.0	34	28
31	1128	268	14.5	90.	150.	34	28

Table 2
Bluegill Food

Date of feeding, 1982	P-32				mg P/g wet wt	$^{32}P/P$ c/min.mg
	counting date, 1982/83	Decay factor	c/min net	c/min.g.		
09/27	11/07(01)	0.139	5,217	93,800		
28	11/04(19)	0.162	5,917	91,300		
29						
30	11/04(24)	0.177	5,264	74,400		
10/01						
02						
03	11/04(20)	0.207	1,887	22,800	1.37	16,642
04						
05	10/26(03)	0.365	2,269	15,540	1.13	13,752
06	11/04(19)	0.239	400	4,180	0.771	5,421
07	11/04(19)	0.251	843	8,400	1.22	6,885
08	11/04(24)	0.261	513	4,910	1.21	4,058
09	11/04(23)	0.275	1,815	16,500	1.38	11,956
10	11/06(23)	0.262	992	9,470	1.30	7,284
11	11/06(22)	0.275	717	6,520	1.32	4,939
12	11/04(23)	0.319	655	5,130	1.13	4,540
13						
14						
15	01/19(20)	0.0095	19.0	5,000	1.30	3,846
16	01/19(22)	0.0099	41.8	10,560	1.51	6,993
17	01/19(24)	0.0104	20.2	4,860	0.975	4,985
18	01/20(01)	0.0109	16.4	3,760	1.30	2,892
19	01/20(03)	0.0113	13.8	3,050	1.44	2,118
20	01/20(	0119	12.8	2,690	1.07	2,514
21	01/20(06)	0.0124	47.0	9,480	1.48	6,405
22	01/20(11)	0.0129	37.5	7,270	1.32	5,508
23	01/20(12)	0.0135	56.0	10,370	1.33	7,797
24	01/20(14)	0.0142	38.0	6,690	1.24	5,395
25	01/20(16)	0.0148	33.2	5,610	1.20	4,675
26	01/20(17)	0.0155	45.4	7,320	1.03	7,106
27	01/20(19)	0.0162	51.4	7,930	1.17	6,777
	01/20(21)	0.0162	69.8	10,770	1.35	7,977
28	01/20(22)	0.0169	95.4	14,110	1.45	9,731
29	01/20(24)	0.0177	38.2	5,400	1.43	3,776
30	01/21(02)	0.0185	63.8	8,620	1.11	7,766
31	01/21(03)	0.0194	60.2	7,760	1.11	6,991

Table 2 cont'd
Bluegill Food

Date of feeding, 1982	Vial No.	Weight, mg. Dry	Ash	amt. fed, g E	W	Number of fish E	W
11/01	1129	287	16.1	85.2	20.1	34	28
02	1130	232	13.4	80.1	105.2	29	25
03	1131	219	12.4	65.3	110.5	29	25
04	1132	279	15.0	40.5	90.2	29	25
05	1134	212	12.3	71.3	103.4	29	25
06	1135	254	13.7	61.7	111.8	29	25
07	1136	297	14.8	50.8	101.3	29	25
08	1137	212	12.3	60.1	81.3	29	25
09	1138	315	15.1	55.2	85.6	26	22
10	1139	282	15.3	42.3	78.2	26	22
11	1140	374	19.2	40.5	55.3	26	22
12	1141	308	15.8	25.3	42.6	26	22
13	1142	291	15.6	38.5	63.2	26	22
14	1143	243	14.0	50.3	72.6	26	22
15	1144	314	16.5	55.1	85.3	26	22
16	1145	307	16.7	41.3	70.4	26	22

Notes: 1. Feed samples were worms, 2 g moist weight; 20-ml aliquots of 100-ml samples were counted

2. Amount fed is moist weight; total amount was based on estimated fish weight, as 1.5% (E) or 3.0% (W) of body weight. Lesser amounts were fed if fish reduced their intake.

Table 2 cont'd
Bluegill Food

Date of feeding, 1982	P-32 counting date, 1982/83	Decay factor	c/min net	c/min.g.	mg P/g wet wt	$^{32}P/P$ c/min.mg
11/01	01/21(05)	0.020	45.8	5,720	1.14	5,018
02	01/21(07)	0.021	67.4	8,020	1.05	7,638
03	01/21(08)	0.022	62.0	7,050	0.930	7,580
04	01/21(10)	0.023	50.1	5,450	1.15	4,739
05	01/21(13)	0.024	45.0	4,690	0.882	5,317
06	01/21(15)	0.025	39.5	3,950	1.11	3,559
07	01/21(17)	0.027	107.	9,910	1.23	8,057
08	01/21(18)	0.028	67.2	6,000	0.935	6,417
09	01/21(20)	0.029	5.6	483	1.35	358
10	01/21(22)	0.030	73.0	6,080	1.24	4,903
11	01/21(23)	0.032	277.	21,640	1.66	13,036
12	01/22(01)	0.033	123.	9,320	1.32	7,060
13	01/22(03)	0.035	133.	9,500	1.28	7,422
14	01/22(04)	0.036	102.	7,080	1.10	6,436
15	01/22(06)	0.038	116.	7,630	1.45	5,262
16	01/22(08)	0.039	117.	7,500	1.30	5,769

Table 3
P-32 Uptake in Catfish
Muscle

Fish No.(1)	Date of death, 1982 (hr)	Weight, (2) wet	dry	ashed	Sample No.
351E	08/16	69.1	17.1	955	101*(4)
317E	(08)	93.9	--	1,130	17
362E		87.4	18.6	1,170	107
395W		70.9	16.1	841	47*
418W		66.8	15.4	601	16
409W		105.3	26.3	1,260	15
359E	08/17	78.3	18.5	1,360	22*
357E	(08)	32.9	10.1	498	104
		34.5	9.06	461	109
		33.1	8.72	475	112
300E		47.5	14.1	664	100
		52.6	13.4	630	159
421W		95.5	21.3	1,430	23*
422W		38.9	8.89	430	44
		29.3	7.07	383	108
380W		39.8	9.50	637	24
		31.3	7.77	420	103
		24.6	6.23	---	76
365E	08/18	70.1	--	773	18
361E	(08)	119.0	29.1	1,440	128
385E		98.6	24.4	1,110	160
373W		79.9	19.3	1,030	127
424W		86.1	21.5	1,020	126
398W		49.7	10.0	446	195
307E	08/24	63.3	16.0	701	123
	(08)	35.6	8.78	444	124
449E		117.8	28.9	1,490	135
276E		70.6	18.4	838	116
372W		110.3	30.3	1,260	125
401W		100.7	19.9	1,180	42
416W		88.7	20.2	1,020	114

(1) E fish received twice as much feed as W fish, at same specific activity (2) Wet and dry weight in gram; ashed weight in mg. (3) Duplicate 20-ml aliquots of 100-ml samples were analyzed for P-32 by Cherenkov counting with 50-min. counts when < 200 c/min and 10-min. counts when > 200 c/min. (4) One asterisk indicates a 200-ml solution and two asterisks, 250-ml. (5) Weight appears to be erroneous (6) Average of 2 or more measurements.

Table 3
P-32 Uptake in Catfish
Muscle

Fish No.(1)	Date of counting, 1982 (hr)	P-32 decay fraction	P-32 net c/min.(3)	P-32 c/min.g. wet	P, mg/g	P-32/P, c/min.mg.
351E	09/17(13)	0.209	306	212	2.28	93.0
317E	08/31(17)	0.474	4,240	476	2.17	219.
362E	09/17(09)	0.212	199	53.7	2.26	23.8
395W	09/07(21)	0.336	14.3	6.0	2.30	2.6
418W	08/31(03)	0.488	15.5	2.4	1.70	1.4
409W	08/31(02)	0.488	31.0	3.0	2.07	1.5
359E	09/01(10)	0.481	537	143.	2.18	65.6
357E	09/17(03)	0.225	42.2	28.5	2.36	12.1
	09/17(17)	0.219	49.2	32.6	2.36	13.8
	09/17(21)	0.218	39.0	27.0	2.25	12.0
300E	09/17(13)	0.220	535	256	2.16	119.
	09/21(14)	0.183	547	284	2.42	117.
421W	08/31(18)	0.493	414	87.9	1.71	51.4
422W	09/03(08)	0.439	18.6	5.4	2.25	2.4
	09/17(16)	0.219	13.8	10.8	2.22	4.9
380W	08/31(18)	0.493	157	40.0	1.85	21.6
	09/16(16)	0.230	85.4	59.3	2.25	26.4
	09/14(17)	0.252	55.0	44.5	2.37	18.8
365E	08/31(18)	0.522	1,518	207	3.02	68.5
361E	09/20(16)	0.199	2,627	555	2.48	224.
385E	09/21(14)	0.190	1,317	351	2.16(6)	163.
373W	09/20(15)	0.199	755	237	2.55	92.9
424W	09/20(15)	0.199	321	93.7	2.46	38.1
398W	09/29(07)	0.131	206	158	1.80(6)	87.8
307E	09/20(14)	0.264	7,137	2,140	2.17	986.
	09/20(14)	0.264	4,169	2,220	2.20	1,009.
449E	09/21(10)	0.256	2,965	492	2.37	208.
276E	09/20(11)	0.269	5,845	1,539	2.72	566.
372W	09/20(14)	0.264	1,038	178	2.25	79.1
401W	09/02(18)	0.627	10,280	814	2.26	360.
416W	09/20(11)	0.269	8,040	1,691	2.18	776.

Table 3 cont'd
P-32 Uptake in Catfish
Muscle

Fish No.(1)	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.
314E	8/26	45.4	10.9	489	257
	(08)	54.2	13.3	597	258
369E		57.7	11.9	641	282
		47.3	9.89	545	276
332E		46.2	10.7	536	279
		43.7	10.5	496	278
448W		31.5	7.64	383	284
		43.2	10.0	495	275
439W		57.0	12.9	647	280
		71.0	15.2	784	316
389W		57.6	14.8	666	281
		64.2	17.4	705	619
355E	9/01	51.4	---	583	261
	(08)	50.0	---	576	270
393E		77.0	16.5	903	671
348E		33.4	7.68	377	674
		38.0	9.03	430	752
414W		47.2	11.0	536	745
		59.5	---	676	260
403W		49.6	11.1	494	656
404W		65.9	---	759	271
		30.0	6.80	331	675
321E	9/10	83.0	17.9	943	267
363E	(08)	36.5	8.06	418	197
		54.4	12.2	608	225
356E		25.7	5.44	313	222
387W		91.8	20.0	1,060	266
429W		74.8	14.6	865	198
431W		79.0	16.4	919	227
428W	9/23	129.1	29.2	1,620	291
410W	(08)	91.0	18.8	1,110	272
390W		91.9	20.2	1,080	306

Table 3 cont'd
P-32 Uptake in Catfish
Muscle

	P-32					
Fish No.(1)	Date of counting, 1982 (hr)	decay fraction	net c/min.	c/min.g. wet	P, mg/g	P-32/P, c/min.mg.
314E	10/08(14)	0.123	1,532	1,373	2.05(6)	670
	10/08(14)	0.123	1,844	1,384	2.07	669
369E	10/11(12)	0.107	2,401	1,950	2.27(6)	859
	10/11(09)	0.107	1,983	1,965	2.59	759
332E	10/11(10)	0.107	1,324	1,343	2.33	576
	10/11(10)	0.107	1,002	1,075	2.16	498
448W	10/12(17)	0.100	189	300	2.39	126
	10/11(09)	0.107	250	271	2.12(6)	128
439W	10/11(11)	0.107	2,333	1,918	2.15	892
	10/14(11)	0.092	2,349	1,790	2.14	836
389W	10/11(11)	0.107	1,741	1,416	2.27	624
	11/17(13)	0.018	347	1,493	2.26	661
355E	10/08(15)	0.164	2,242	1,330	2.16	616
	10/08(17)	0.164	2,466	1,501	2.31(6)	655
393E	11/23(12)	0.018	334	1,205	2.42	498
348E	11/23(13)	0.018	275	2,290	2.20	1,041
	12/02(13)	0.012	211	2,310	2.12(6)	1,090
414W	12/01(22)	0.012	98.2	867	2.13	407
	10/08(15)	0.164	1,528	783	2.14	366
403W	11/22(20)	0.018	22.7	127	1.93(6)	65.8
404W	10/08(17)	0.164	1,809	836	1.10(6)	760
	11/23(14)	0.018	188	1,741	2.48	702
321E	10/08(16)	0.254	741	176	2.30	76.5
363E	09/30(15)	0.374	2,083	763	2.24	341
	09/30(22)	0.370	3,142	780	2.14	364
356E	09/30(21)	0.370	202	106	2.34	45.3
387W	10/08(16)	0.254	4,263	914	2.48	369
429W	09/30(15)	0.374	2,111	377	2.22	170
431W	09/30(22)	0.370	1,893	324	2.30	141
428W	10/13(09)	0.379	10,950	1,119	2.56	437
410W	10/08(17)	0.474	7,943	921	2.47	373
390W	10/13(16)	0.374	1,750	255	2.40	106

Table 3 cont'd
P-32 Uptake in Catfish
Skeleton

Fish No.	Date of death, 1982 (hr)	Weight, wet	dry	ashed	Sample No.
351E	08/16	19.0	7.17	1,350	41*
317E	(08)	19.1	7.90	1,460	11/12
362E		19.8	7.44	1,370	117
395W		22.6	8.66	1,760	7/8
418W		16.7	7.13	1,110	118
409W		21.1	8.79	1,440	28*
359E	08/17	18.4	7.26	1,220	157
357E	(08)	18.0	8.09	1,460	158
300E		16.5	7.26	1,300	119
421W		17.7	7.86	1,670	106*
422W		12.2	5.07	926	130
380W		17.5	7.80	1,670	131
365E	08/18	10.4	4.12	732	133
361E	(08)	17.7	8.03	1,570	122
385E		18.1	8.07	1,330	121
373W		15.7	6.46	1,200	120
424W		12.6	5.74	1,000	132
398W		7.3	3.03	599	134
307E	08/24	17.2	6.45	1,250	35
449E	(08)	22.6	--	---	129
276E		14.5	5.88	870	115
372W		26.4	11.0	1,630	162
401W		24.5	9.25	1,680	163
416W		20.7	8.07	1,610	164

Table 3 cont'd
P-32 Uptake in Catfish
Skeleton

	P-32					
Fish No.	Date of counting, 1982 (hr)	decay fraction	net c/min.	c/min.g. wet	P, mg/g	P-32/P, c/min.mg.
351E	09/03(02)	0.423	303	377	14.9	25.3
317E	08/31(15)	0.476	1,296	712	15.8	45.1
362E	09/17(20)	0.207	103.2	126	14.7	8.57
395W	08/30(18)	0.498	7.5	3.3	17.2	0.192
418W	09/17(22)	0.206	6.4	9.3	13.0	0.715
409W	09/01(04)	0.465	<2.2	<2.2	13.8	<0.16
359E	09/21(13)	0.182	154	230	13.3	17.3
357E	09/24(07)	0.159	28.7	50.1	17.0	2.95
300E	09/20(12)	0.200	215	326	15.5	21.0
421W	09/17(05)	0.225	85.3	214	9.30	23.0
422W	09/22(12)	0.173	<2.2	<5.2	15.1	<0.34
380W	09/22(14)	0.173	52.7	87.0	19.7	4.42
365E	09/21(09)	0.191	209	526	13.3	39.5
361E	09/20(13)	0.200	727	1,027	18.0	57.1
385E	09/20(13)	0.200	358	494	14.9	33.2
373W	09/20(12)	0.200	195	311	14.3	21.7
424W	09/23(12)	0.173	76.9	176	16.2	10.9
398W	09/21(10)	0.191	103.6	372	13.0	28.6
307E	09/02(16)	0.636	8,480	3,880	14.5	268
449E	09/21(09)	0.256	707	611	14.3	42.7
276E	09/20(11)	0.269	2,036	2,610	12.0	218
372W	09/21(14)	0.254	310	231	11.0	21.0
401W	09/21(14)	0.254	1,323	1,063	12.5	85.0
416W	09/21(15)	0.254	2,296	2,183	13.9	157

Table 3 cont'd
P-32 Uptake in Catfish
Skeleton

Fish No.	Date of death, 1982 (hr)	Weight, wet	dry	ashed	Sample No.
314E	8/26	19.2	7.93	1,270	259
369E	(08)	17.5	6.72	1,400	277
332E		20.0	7.24	1,400	269
448W		13.5	5.45	1,120	263
439W		22.2	9.46	1,750	450
389W		20.1	8.87	1,480	262
355E	9/01	23.6	8.58	1,620	256
393E	(08)	(20.0)	8.38	1,500	632
348E		17.1	5.97	1,000	631
414W		22.4	8.47	1,580	637
403W		13.0	4.84	971	668
404W		19.4	7.41	1,480	714
321E	9/10	24.1	8.16	1,480	228
363E	(08)	25.5	8.88	1,400	199
356E		8.1	2.64	434	245
387W		22.5	7.81	1,420	229
429W		22.4	6.80	1,390	254
431W		27.7	9.46	1,700	255
428W	9/23	26.8	9.89	1,840	274
410W	(08)	21.8	7.19	1,300	273
390W		25.2	9.42	1,700	283

Table 3 cont'd
P-32 Uptake in Catfish
Skeleton

Fish No.	Date of counting, 1982 (hr)	P-32 decay fraction	net c/min.	c/min.g. wet	P, mg/g	P-32/P, c/min.mg
314E	10/08(14)	0.123	1,019	2,160	12.4	174
369E	10/11(10)	0.118	1,452	3,520	14.7	239
332E	10/08(17)	0.123	583	1,186	11.4	104
448W	10/08(16)	0.123	155	467	15.6	29.9
439W	11/03(14)	0.035	424	2,710	15.5	175
389W	10/08(15)	0.123	912	1,846	15.3	120
355E	10/08(13)	0.165	2,121	2,720		
393E	11/17(20)	0.023	119	1,290 est.		
348E	11/17(16)	0.023	248	3,150		
414W	11/17(22)	0.023	102	990		
403W	11/23(23)	0.017	3.4	76.9		
404W	11/25(16)	0.016	182	2,930		
321E	09/30(22)	0.368	414	233		
363E	09/30(15)	0.374	4,799	2,520		
356E	10/06(24)	0.274	65.8	148		
387W	09/30(23)	0.368	3,007	1,816		
429W	10/08(13)	0.255	1,216	1,064		
431W	10/21(15)	0.135	347	464		
428W	10/11(09)	0.416	7,913	3,550		
410W	10/21(15)	0.254	2,098	1,894		
390W	10/11(12)	0.416	902	430		

Table 3 cont'd
P-32 Uptake in Catfish
Viscera

Fish No.	Date of death, 1982(hr)	Weight, wet	dry	ashed	Sample No.
351E	08/16	13.0	3.91	131	38
317E	(08)	31.0	9.96	450	13
362E		15.5	4.87	---	85
395W		9.8	2.09	---	83
418W		15.6	5.43	105	59
409W		19.8	7.76	141	55
359E	08/17	17.2	7.14	---	78
357E	(08)	21.6	9.13	155	27
300E		18.4	7.65	---	81
421W		17.7	5.14	253	204
422W		11.5	4.34	---	84
380W		21.3	8.43	---	77
365E	08/18	12.3	4.73	---	87
361E	(08)	31.8	9.00	339	192
385E		19.6	6.56	191	193
373W		11.8	3.19	121	63
424W		16.9	7.36	---	79
398W		7.3	2.38	53.2	62
307E	08/24	30.6	9.86	487	185
449E	(08)	21.2	6.75	173	156
276E		16.1	6.26	153	36
372W		25.3	11.6	183	152
401W		20.3	4.57	237	75
416W		29.2	9.14	356	153

Table 3 cont'd
P-32 Uptake in Catfish
Viscera

Fish No.	Date of counting, 1982 (hr)	P-32 decay fraction	net c/min.	c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg.
351E	09/02(16)	0.298	1,608	2,080	2.05	1,015
317E	08/31(15)	0.476	8,340	2,820	1.50	1,880
362E	09/15(09)	0.233	214	296	1.44	206
395W	09/14(24)	0.237	<2.2	<4.7	1.57	< 3.0
418W	09/08(08)	0.328	<2.2	<2.1	1.49	< 1.5
409W	09/08(02)	0.332	<2.2	<1.7	1.75	< 1.0
359E	09/15(08)	0.257	384	434	1.20	362
357E	08/31(14)	0.501	655	303	1.62	187
300E	09/15(09)	0.257	485	513	1.11	462
421W	09/30(16)	0.117	197	476	1.47	324
422W	09/15(01)	0.249	<2.2	<3.8	1.39	< 2.7
380W	09/14(19)	0.252	144	134	1.34	100
365E	09/15(10)	0.256	386	613	1.33	461
361E	09/30(13)	0.123	2,615	3,340	1.70	1,965
385E	09/30(13)	0.123	1,468	3,040	1.85	1,643
373W	09/10(14)	0.320	1,210	1,602	2.63	609
424W	09/15(09)	0.256	314	363	1.63	223
398W	09/10(17)	0.320	243	520	1.45	359
307E	09/30(12)	0.165	8,526	8,440	2.30	3,670
449E	09/21(13)	0.255	1,348	1,247	1.36	917
276E	09/02(16)	0.631	9,050	4,450	1.66	2,680
372W	09/21(13)	0.254	1,744	1,357	1.50	905
401W	09/10(16)	0.428	9,263	5,330	1.79	2,980
416W	09/21(13)	0.255	8,818	5,920	1.96	3,020

Table 3 cont'd
P-32 Uptake in Catfish
Viscera

Fish No.	Date of death, 1982(hr)	Weight, wet	dry	ashed	Sample No.
314E	8/26	40.5	12.9	588	372
369E	(08)	33.7	8.55	316	330
332E		27.5	6.84	425	363
448W		15.5	5.51	116	308
439W		42.7	11.4	616	360
389W		31.7	10.7	391	331
355E	9/01	32.9	10.2	267	744
393E	(08)	15.2	3.00	158	751
348E		26.9	9.01	296	716
414W		23.2	7.75	163	669
403W		12.4	3.23	97.2	639
404W		24.4	7.23	232	707
321E	9/10	15.4	3.63	150	251
363E	(08)	25.7	6.49	276	344
356E		5.8	1.89	42.5	247
378W		26.9	7.11	300	252
429W		14.8	3.34	128	236
431W		17.8	3.53	240	221
428W	9/23	25.1	8.39	211	336
410W	(08)	18.9	6.19	174	357
390W		20.1	5.18	219	337

Table 3 cont'd
P-32 Uptake in Catfish
Viscera

Fish No.	Date of counting, 1982 (hr)	P-32 decay fraction	net c/min.	c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg.
314E	10/21(13)	0.066	3,354	6,300	2.88	2,190
369E	10/15(11)	0.089	2,630	3,660	1.56	2,350
332E	10/21(12)	0.066	2,189	6,060	2.56	2,370
448W	10/13(17)	0.096	206	691	1.39	497
439W	10/21(12)	0.066	2,970	5,290	2.41	2,200
389W	10/15(11)	0.089	2,906	5,170	2.03	2,550
355E	12/01(22)	0.012	83.0	1,051	1.46	720
393E	12/02(01)	0.012	55.0	1,508	1.81	833
348E	11/25(20)	0.016	523	6,080	1.94	3,130
414W	11/24(01)	0.017	77.4	981	1.26	779
403W	11/17(23)	0.023	8.9	156	1.37	114
404W	11/25(04)	0.016	240	3,070	1.70	1,806
321E	10/08(12)	0.255	751	956	1.52	
363E	10/19(12)	0.150	1,374	1,782	1.71	
356E	10/07(03)	0.273	50.6	160	1.45	
378W	10/08(12)	0.255	3,154	2,300	1.99	
429W	10/21(15)	0.136	479	1,190	1.42	
431W	09/30(20)	0.370	2,362	1,793	2.04	
428W	10/19(11)	0.150	2,221	2,950	1.99	
410W	10/21(11)	0.136	1,029	2,000	1.78	
390W	10/19(11)	0.150	931	1,544	1.91	

Table 4
Catfish Food

Date of feeding, 1982	Vial No.	Dry wt, g	Amt. fed, g		No. of fish	
			E	W	E	W
08/15	438	0.98	238.2	151.2	69	69
16			47.8	33.5	65	64
17			89.0	34.2	62	60
18	423	0.94	78.7	50.7	59	55
19			77.9	115.2	59	55
20			26	18.1	58	54
21	430	0.96	156	81	58	50
22			148	100	58	50
23			86	40	55	50
24			129	65	52	47
25	436	1.02	142	119	52	47
26			20	20	9	15
27	431	1.03	20	20	6	12
28			14.7	13.2	6	12
29			4.9	4.6	6	12
30	429	1.04	7.0	9.2	6	12
	434	1.05				
31			1.3	2.3	6	12
09/01			8.8	3.4	3	9
02	425	0.98	4.3	10.0	3	9
03			6.6	9.3	3	9
04			4.8	15.0	3	9
05	427	1.01	4.2	8.6	3	9
06			2.1	8.8	3	9
07			3.1	8.8	3	9
08	421	1.00	2.9	15.0	3	9
09			3.3	9.6	3	9
10			---	1.2	0	6
11	424	0.98	---	3.5	0	6
12			---	3.0	0	6
13					0	6
14	422	0.98	---	12.0	0	6
	428	1.01				

Table 4
Catfish Food

Date of feeding, 1982	P-32 counting date, 1982	Decay factor	net c/min	c/min.g	mg P/g dry wt	P-32/P c/min. mg.
08/15	10/26(02)	0.031	629	103,500	13.5	7,670
16						
17						
18	10/25(21)	0.036	672	99,300	12.5	7,940
19						
20						
21	10/25(23)	0.042	741	91,900	13.4	6,860
22						
23						
24						
25	10/26(01)	0.050	937	91,900	14.5	6,340
26						
27	10/25(24)	0.055	1,070	94,400	14.2	6,650
28						
29						
30	10/25(23)	0.065	1,238	91,600	13.0	7,046
	10/26(01)	0.065	1,203	88,100	14.6	6,034
31						
09/01						
02	10/25(22)	0.071	659	47,400	14.4	3,292
03						
04						
05	10/25(22)	0.082	801	48,400	14.4	3,361
06						
07						
08	10/25(20)	0.095	904	47,600	13.2	3,606
09						
10						
11	10/25(21)	0.110	1,119	51,900	15.1	3,437
12						
13						
14	10/25(21)	0.127	1,209	48,600	14.6	3,329
	10/25(23)	0.127	1,158	45,100	15.8	2,854

Table 4 cont'd
Catfish Food

Date of feeding, 1982	Vial No.	Dry wt, g	Amt. fed, g		No. of fish	
			E	W	E	W
09/15				5.2	0	6
16				5.3	0	6
17	426	1.00	---	9.9	0	6
18				8.3	0	6
19				10.6	0	6
20				9.	0	6
21	435	1.02	---	3.1	0	6
22					0	6
23				1.2	0	3

Notes: 1. 20-ml aliquots of 100-ml samples were counted.
2. Amount fed was based on estimated fish weight, as 2.0% (E) or 1.0% (W) of body weight. Lesser amounts were fed if fish reduced their intake.

Table 4 cont'd
Catfish Food

Date of feeding, 1982	P-32 counting date, 1982	Decay factor	net c/min	c/min.g	mg P/g dry wt	P-32/P c/min. mg.
09/15						
16						
17	10/25(22)	0.147	1,337	45,500	14.7	3,095
18						
19						
20						
21	10/26(01)	0.177	1,543	42,700	13.5	3,163
22						
23						

Table 5a

Catfish Wet Weight

Fish Number	Weight, g Start	Death
	08/09	08/16
351 E	175.0	179.7
317 E	220.0	240.7
362 E	207.0	209.4
395 W	193.0	186.8
418 W	186.0	179.0
409 W	258.0	231.9
		08/17
359 E	199.0	
357 E	244.0	236.5
300 E	227.5	225.5
421 W	226.0	
422 W	163.0	155.0
380 W	236.0	235.5
		08/18
365 E	146.0	142.3
361 E	261.0	265.6
385 E	226.5	232.7
373 W	191.0	193.8
424 W	193.5	193.3
398 W	107.0	104.0
		08/24
307 E	201.0	237.8
449 E	284.0	260.7
276 E	157.0	165.1
372 W	261.0	261.4
401 W	223.0	244.9
416 W	211.0	234.1

Note: Fish were initially weighed before P-32 feeding was begun on 08/15.

Table 5a cont'd

Catfish Wet Weight

Fish Number	Weight, g Start	Death
	08/09	08/26
314 E	208.0	250.0
369 E	196.0	250.0
332 E	202.0	224.0
448 W	179.0	173.0
439 W	267.0	325.0
389 W	241.5	270.0
		09/01
355 E	243.0	260.7
393 E	189.0	208.6
348 E	156.0	181.0
414 W	254.0	256.3
403 W	145.5	134.4
404 W	227.5	226.7
		09/10
321 E	200.0	205.8
363 E	216.0	258.5
356 E	78.0	70.6
387 W	201.0	229.7
429 W	182.0	193.3
431 W	205.0	
		09/23
428 W	234.0	297.2
410 W	185.5	223.7
390 W	225.0	225.0

Table 5a cont'd

Catfish Wet Weight

Fish Number	Weight gain, d^{-1}
351 E	0.004
317 E	0.013
362 E	0.002
395 W	- 0.005
418 W	- 0.005
409 W	- 0.015
Avg E	0.006
Avg W	- 0.008
359 E	---
357 E	- 0.004
300 E	- 0.001
421 W	---
422 W	- 0.006
380 W	0.000
Avg E	- 0.002
Avg W	- 0.003
365 E	- 0.003
361 E	0.002
385 E	0.003
373 W	0.002
424 W	0.000
398 W	- 0.003
Avg E	0.001
Avg W	0.000
307 E	0.011
449 E	- 0.006
276 E	0.003
372 W	0.000
401 W	0.006
416 W	0.007
Avg E	0.003
Avg W	0.004

Table 5a cont'd

Catfish Wet Weight

Fish Number	Weight gain, d^{-1}
314 E	0.011
369 E	0.014
332 E	0.006
448 W	- 0.002
439 W	0.012
389 W	0.007
Avg E	0.010
Avg W	0.006

Table 5b

Bluegill Wet Weight

Fish No.	Weight, g			
	9/03	10/01	11/12	Death Date
				09/28
761 E	118.0			114.5
794 E	130.0			119.6
879 E	151.0			153.3
499 W	121.0			121.6
708 W	111.0			123.6
787 W	142.5			149.4
				09/29
684 E	159.0			156.5
859 E	133.5			139.8
863 E	95.0			93.6
608 W	102.5			107.9
682 W	137.0			148.7
890 W	126.0			139.7
				09/30
619 E	106.5			122.4
872 E	152.0			153.5
635 E	135.0			142.5
706 W	131.0			133.8
704 W	121.5			119.2
480 W	150.6			158.5
				10/06
759 E	113.5	103.9		98.6
674 E	95.0	101.1		102.4
762 E	122.5	119.8		114.0
613 W	96.0	102.7		103.5
680 W	80.5	84.5		82.4
792 W	105.0	114.4		109.2
				10/12
699 E	143.0	142.8		147.2
784 E	138.9	153.1		148.3
733 E		109.4		107.6
488 W	110.9	115.3		118.5
490 W	85.6	93.3		98.5
476 W	153.5	163.1		164.9

Notes: 1) Fish were initially weighed before feeding was begun on 09/27.
2) Weighing on 10/01 was not used to compute weight changes for fish killed on 10/06, and weighing on 11/12 was not used to compute weight change for fish killed on 11/17 because of short time interval.

Table 5b cont'd

Bluegill Wet Weight

Fish No.	Weight, g			
	9/03	10/01	11/12	Death Date
				10/19
769 E	94.0	101.0		101.4
482 E	94.6	92.0		92.9
677 E	119.0	105.2		116.1
497 W	81.0	83.4		86.9
873 W	132.0	149.5		161.4
607 W	164.0	159.3		172.4
				10/26
876 E	93.0	99.5		105.0
763 E	129.0	132.8		140.5
881 E	89.5	88.1		85.9
785 W	130.5	135.5		147.6
716 W		135.7		148.6
875 W	145.0	153.5		158.2
				11/03
882 E	119.0	111.2		117.0
456 E	89.5	91.4		91.5
627 E	130.0	141.8		151.1
858 E	149.0	148.2		149.7
722 E	125.0	124.1		126.4
884 W	106.0	117.0		116.7
672 W	121.0	118.1		119.7
679 W	140.0	148.6		154.7
				11/09
799 E	122.0	118.5		124.1
790 E	120.5	135.7		132.6
486 E	146.0	134.4		132.6
602 W	134.5	136.6		135.0
893 W	119.0	109.1		118.0
798 W	150.5	161.7		169.2
				11/17
899 E	118.0	117.3	120.2	120.8
713 E	93.0	94.0	94.5	96.9
880 E	129.0	120.1	120.5	118.8
886 W	124.0	135.6	155.2	162.7
622 W	118.5	126.9	139.9	145.0
698 W	135.0	139.1	144.7	146.9

Table 5b cont'd

Bluegill Wet Weight

Fish No.	Weight, g			
	9/03	10/01	11/12	Death Date
				11/20
782 E	142.0	155.0	160.6	160.0
767 E	159.0	166.0	172.4	171.3
728 E		149.0	164.6	162.7
715 W		151.7	164.2	166.0
889 W	104.5	154.5	169.8	169.5
606 W	153.5	175.4	196.5	196.5
				11/24
477 E	135.0	140.7	148.9	147.0
738 E	114.0	111.0	115.3	115.7
691 E	140.0	155.0	161.5	160.7
668 W	131.0	150.3	161.2	161.1
717 W		108.9	117.8	118.3
891 W	135.0	143.3	143.2	143.3
				11/30
637 E	126.0	132.6	143.7	149.0
721 E		106.6	108.7	112.0
723 E		118.6	122.7	128.2
892 W	153.0	179.1	214.9	225.0
885 W	91.0	102.0	112.4	117.5
636 W	140.5	151.7	164.2	174.7
				12/07
730 E		117.6	123.2	125.6
871 E	112.5	121.9	122.2	122.8
705 E	155.5	148.5	143.7	148.4
641 W	96.0	96.4	102.4	109.2
615 W	128.0	146.6	156.1	154.1
735 W	98.0	95.5	105.0	113.2
				12/15
694 E	119.0	120.8	121.9	135.5
485 E	142.0	142.9	161.8	166.6
894 E	160.0	172.1	176.7	184.6
692 W	150.0	161.8	186.5	201.3
854 W	132.0	140.2	155.3	163.3
630 W	104.0	105.6	112.3	121.8

Table 5b cont'd

Bluegill Wet Weight

Fish No.	Weight gain, d^{-1} 09/03 on	10/01 on	11/12 on
761 E	- 0.001		
794 E	- 0.003		
879 E	0.001		
499 W	0.002		
708 W	0.004		
787 W	0.002		
Avg E	- 0.001		
Avg W	0.002		
684 E	- 0.001		
859 E	0.002		
863 E	- 0.001		
608 W	0.002		
682 W	0.003		
890 W	0.004		
Avg E	0.000		
Avg W	0.003		
619 E	0.005		
872 E	0.000		
635 E	0.002		
706 W	0.001		
704 W	- 0.001		
480 W	0.002		
Avg E	0.002		
Avg W	0.001		
759 E	- 0.004		
674 E	0.002		
762 E	- 0.002		
613 W	0.002		
680 W	0.001		
792 W	0.001		
Avg E	- 0.001		
Avg W	0.001		

Table 5b cont'd

Bluegill Wet Weight

Fish No.	Weight gain, d^{-1} 09/03 on	10/01 on	11/12 on
699 E	0.000	0.003	
784 E	0.003	- 0.003	
733 E	---	- 0.002	
488 W	0.001	0.002	
490 W	0.003	0.005	
476 W	0.002	0.001	
Avg E	0.001	- 0.001	
Avg W	0.002	0.003	
769 E	0.003	0.000	
482 E	- 0.001	0.000	
677 E	- 0.004	0.005	
497 W	0.001	0.002	
873 W	0.004	0.004	
607 W	- 0.001	0.004	
Avg E	- 0.001	0.002	
Avg W	0.001	0.003	
876 E	0.002	0.002	
763 E	0.001	0.002	
881 E	- 0.001	- 0.001	
785 W	0.001	0.003	
716 W	---	0.004	
875 W	0.002	0.001	
Avg E	0.001	0.001	
Avg W	0.002	0.003	
882 E	- 0.002	0.002	
456 E	0.001	0.000	
627 E	0.003	0.002	
858 E	0.000	0.000	
722 E	0.000	0.001	
884 W	0.004	0.000	
672 W	- 0.001	0.000	
679 W	0.002	0.001	
Avg E	0.000	0.001	
Avg W	0.002	0.000	

Table 5b cont'd

Bluegill Wet Weight

Fish No.	Weight gain, d^{-1} 09/03 on	10/01 on	11/12 on
799 E	- 0.001	0.001	
790 E	0.004	- 0.001	
486 E	- 0.003	0.000	
602 W	0.001	0.000	
893 W	- 0.003	0.002	
798 W	0.003	0.001	
Avg E	0.000	0.000	
Avg W	0.000	0.001	
899 E	0.000	0.001	
713 E	0.000	0.001	
880 E	- 0.003	0.000	
886 W	0.003	0.004	
622 W	0.002	0.003	
698 W	0.001	0.001	
Avg E	- 0.001	0.001	
Avg W	0.002	0.003	
782 E	0.003	0.001	0.000
767 E	0.002	0.001	- 0.001
728 E	---	0.002	- 0.001
715 W	---	0.002	0.001
889 W	---	0.002	0.000
606 W	0.005	0.003	0.000
Avg E	0.002	0.001	- 0.001
Avg W	---	0.002	0.000
477 E	0.001	0.001	- 0.001
738 E	- 0.001	0.001	0.000
691 E	0.003	0.001	0.000
668 W	0.005	0.002	0.000
717 W	---	0.002	0.000
891 W	0.002	0.000	0.000
Avg E	0.001	0.001	0.000
Avg W	0.004	0.001	0.000

Table 5b cont'd

Bluegill Wet Weight

Fish No.	Weight gain, d^{-1} 09/03 on	10/01 on	11/12 on
637 E	0.002	0.002	0.002
721 E	---	0.000	0.002
723 E	---	0.001	0.002
892 W	0.006	0.004	0.003
885 W	0.004	0.002	0.002
636 W	0.003	0.002	0.003
Avg E	---	0.001	0.002
Avg W	0.004	0.003	0.003
730 E	---	0.001	0.001
871 E	0.003	0.000	0.000
705 E	- 0.002	- 0.001	0.001
641 W	0.000	0.001	0.003
615 W	0.005	0.001	0.000
735 W	- 0.001	0.002	0.003
Avg E	0.000	0.000	0.001
Avg W	0.001	0.001	0.002
694 E	0.000	0.000	0.003
485 E	0.000	0.003	0.001
894 E	0.003	0.001	0.001
692 W	0.003	0.004	0.002
854 W	0.002	0.002	0.002
630 W	0.000	0.001	0.002
Avg E	0.001	0.001	0.002
Avg W	0.002	0.002	0.002

Table 7

P-32 in Suspended Solids During Bluegill Uptake and Depuration Study

Collection date, 1982 (hr)	Sample	Vial No.	P-32 Counting date, 1982-1983 (hr)	Decay fraction	net c/min	c/min. L
11/09	E-large	945	12/23(16)	0.125	12.0	1.4
	E-250 μ	944	12/22(06)	0.127	21.7	2.6
	E-75 μ	811	12/11(05)	0.217	66.5	8.0
	E-0.45 μ (4)	1042	01/07(20)	0.057	<2.2	<380
		808	12/10(04)	0.228	<2.2	<100
		814	12/11(08)	0.216	2.4	110
		809	12/10(06)	0.228	<2.2	<100
	W-large	810	12/11(03)	0.218	5.4	0.65
	W-250 μ	1008	12/31(10)	0.082	9.6	1.2
	W-75 μ	922	12/21(15)	0.131	39.3	4.7
	W-0.45 μ (4)	923	12/21(17)	0.131	<2.2	<170
		940	12/22(03)	0.128	<2.2	<170
		924	12/21(18)	0.130	<2.2	<170
		941	12/22(04)	0.128	<2.2	<170
11/20	E	1167	02/02(14)	0.027	3.9	30
	W	1172	02/02(22)	0.027	<2.2	<17
11/24	E	1174	02/03(02)	0.032	<2.2	<14
	W	1168	02/02(16)	0.033	<2.2	<14
11/30	E	1169	02/02(17)	0.046	<2.2	<10
	W	1171	02/02(20)	0.046	<2.2	<10
12/07	E	1173	02/02(24)	0.061	<2.2	<8
	W	1170	02/02(19)	0.062	<2.2	<8
12/15	E	1166	02/02(12)	0.093	<2.2	<5
	W	1165	02/02(10)	0.093	<2.2	<5

Notes: 1. For 11/09 samples, water volume was 41.5 L but only 0.50 L was passed through each 0.45-μ filter; samples were made up to 100 ml

2. For all other samples, water volume was 24 L and samples were made up to 100 ml

3. Large solids were collected on 11/09 with a small net; solids were collected on all other dates by siphoning them from the aquarium bottom and retaining them on a 75-μ filter

Table 7 cont'd

P-32 in Suspended Solids During Bluegill Uptake and Depuration Study

Vial No.	P, mg/L	P-32/P, c/min.mg.
945	0.018	640
944	0.011	1,900
811	0.022	1,700
1042	< 0.2	---
808	< 0.2	---
814	< 0.2	---
809	< 0.2	---
810	0.0020	1,500
1008	0.0052	2,700
922	0.024	1,500
923	< 0.2	---
940	< 0.2	---
924	< 0.3	---
941	< 0.3	---
1167	0.083	360
1172	0.091	< 200
1174	0.056	< 200
1168	0.065	< 200
1169	0.134	< 100
1171	0.087	< 100
1173	0.088	< 100
1170	0.083	< 100
1166	0.063	< 100
1165	0.025	< 200

Table 8
Non-food Uptake of 32-P

Fish No.(1)	Date of death,(2) 1982 (hr)	Weight, (3) wet	dry	ashed	Sample No.
		Bluegill Muscle			
683 B	12/10	57.7	11.2	714	927
857 B	(12)	70.4	14.2	854	926
626 U		40.8	7.94	529	965
628 U		22.1	4.44	298	917
638 U		11.8	2.34	154	967
878 U		38.5	7.59	509	920
		Catfish Muscle			
210.1 B	12/17	61.4	14.0	725	1087
160.4 B	(11)	51.0	11.9	591	1072
150.7 B		49.6	11.4	---	Lost
137.0 U		33.7	9.62	485	1086
117.4 U		35.8	8.09	413	1064
128.0 U		38.3	8.90	436	1079

Notes: (1) B: blocked esophagus; U: unblocked
(2) Bluegill exposure began on 12/6 (1700) except for #857 and 878 which were exposed from 12/8(11) to 12/12(11); catfish exposure began on 12/13(1100).
(3) Wet and dry weight in gram; ashed weight in mg.
(4) Month 01 is in 1983.
(5) Average of 2 or more measurements.

Table 8
Non-food Uptake of 32-P

Fish No.(1)	P-32 Date of counting, 1982 (hr)	decay fraction	net c/min	c/min.g. wet	P mg/ g wet	P-32/P, c/min.mg.
	Bluegill Muscle					
683 B	12/21(20)	0.577	174	26.1	2.51	10.4
857 B	12/22(09)	0.562	196	24.8	2.40(5)	10.3
626 U	12/23(07)	0.537	33.5	7.6	2.54	3.0
628 U	12/19(10)	0.649	26.3	9.2	2.50	3.7
638 U	12/23(08)	0.537	22.0	17.4	2.61	6.7
878 U	12/19(14)	0.644	68.9	13.9	2.72	5.1
	Catfish Muscle					
210.1 B	01/13(04)(4)	0.274	74.3	22.1	2.42	9.1
160.4 B	01/12(08)	0.285	86.4	29.7	2.42	12.3
150.7 B	---	---	---	---	---	---
137.0 U	01/13(01)	0.275	27.6	18.2	2.99(5)	6.1
117.4 U	01/11(20)	0.292	26.8	12.8	2.56	5.0
128.0 U	01/12(17)	0.280	37.1	17.3	2.36	7.3

Table 8 cont'd
Non-food Uptake of 32-P

Fish No.(1)	Date of death, 1982 (hr)	Weight, wet	dry	ashed	Sample No.
		Bluegill Skeleton			
683 B	12/10	58.7	16.4	5,104	968
857 B	(12)	45.7	14.9	4,557	1094
626 U		41.4	12.1	4,360	1049
628 U		20.9	4.09	1,317	1051
638 U		8.1	2.37	753	976
878 U		44.2	13.2	4,674	1055
		Catfish Skeleton			
210.1 B	12/17	31.0	10.8	1,940	1084
160.4 B	(11)	24.8	8.32	948	1071
150.7 B		22.4	7.65	878	1044
137.0 U		33.7	7.02	807	1095
117.4 U		20.0	6.43	770	1063
128.0 U		21.0	7.05	872	1067

Table 8 cont'd
Non-food Uptake of 32-P

Fish No.(1)	Date of death, 1982 (hr)	Weight, wet	dry	ashed	Sample No.
		Bluegill Viscera			
683 B	12/10	12.4	2.61	146.	971
857 B	(12)	11.2	2.90	91.5	973
626 U		8.1	1.44	92.0	986
628 U		2.2	0.376	23.8	969
638 U		1.8	0.318	19.8	974
878 U		8.1	1.56	93.7	1052
		Catfish Viscera			
210.1 B	12/17	15.1	3.29	134.	1100
160.4 B	(11)	14.4	4.64	115.	1069
150.7 B		15.3	5.87	103.	1047
137.0 U		12.8	5.94	86.8	1099
117.4 U		9.3	4.13	60.6	1076
128.0 U		12.1	5.22	82.6	1077

Table 8 cont'd
Non-food Uptake of 32-P

Fish No.(1)	Date of counting, 1982 (hr)	P-32 decay fraction	net c/m	c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg.
	Bluegill Viscera					
683 B	12/23(11)	0.533	1,506	1,139	2.40	475
857 B	12/23(12)	0.533	1,281	1,073	2.03	529
626 U	12/23(13)	0.533	185	214	1.87	114
628 U	12/24(10)	0.509	141	630	1.95	323
638 U	12/23(12)	0.533	223	1,162	2.62	444
878 U	01/07(16)	0.255	215	520	2.61	199
	Catfish Viscera					
210.1 B	01/14(05)	0.261	122.	155.	2.29	67.7
160.4 B	01/07(16)	0.356	277.	270.	1.97	137
150.7 B	01/11(02)	0.303	63.6	68.6	2.76	24.9
137.0 U	01/14(03)	0.262	44.1	65.8	1.63	40.4
117.4 U	01/12(14)	0.282	63.6	121.	1.78	68.0
128.0 U	01/07(15)	0.358	135.	156.	1.85	84.3

Table 9

P-32 Concentration in Water for Test of Non-food Uptake

Fish Sampling	Vial No.	Description	date counted	decay fraction	net c/min	c/min ml
Bluegill						
12/10	10	Initial	12/11(11)	0.955	6,633	347
(12)	11	Final T1	12/11(12)	0.953	6,659	349
	12	Final T2	12/11(14)	0.949	6,716	354
	13	Final T3	12/16(23)	0.806	5,145	319
	14	Final T4	12/16(24)	0.804	5,184	322
Catfish						
12/17	20	Initial	12/17(14)	0.994	7,198	362
(11)	21	Final T1	12/17(14)	0.994	7,332	369
	22	Final T2	12/17(15)	0.992	7,017	354
	23	Final T3	12/17(15)	0.992	6,979	352
	24	Final T4	12/17(15)	0.992	6,967	351

Notes: 1) Fish were 2 days in Tanks 1 or 2 and then 2 days in Tanks 3 or 4.
2) Each tank contained 48 L water; 464 g NaH_2PO_4 and 549 g Na_2HPO_4 were dissolved in each tank to obtain a phosphorus concentration of 5.0 mg/L, equimolar in the two species at pH 7.0.

Table 9 cont'd

P-32 Concentration in Water for Test of Non-food Uptake

Vial No.	P, mg/L	P-32/P, c/min.ml.
10	5.44	63,800
11	5.58	62,500
12	5.52	64,100
13	5.88	54,300
14	5.40	59,600
Average Final	5.64	57,000
20	5.40	67,000
21	5.44	67,800
22	5.66	62,500
23	5.59	63,000
24	6.10	57,500
Average Final	5.84	60,200

Table 10

Bluegill and Catfish Wet Weights in Test of Non-food Uptake

Bluegill

Fish Number		Weight, g Start	End
683	B	255.7	265.4
857	B	237.4	239.2
626	U	196.6	193.5
628	U	70.2	70.1
638	U	43.7	42.6
878	U	193.8	190.5

Catfish

Fish Number		Weight, g Start	End
210.1	B	217.8	210.1
160.4	B	168.5	160.4
150.7	B	154.6	150.7
137.0	U	139.1	137.0
117.4	U	122.5	117.4
128.0	U	137.4	128.0

Table 10 cont'd

Bluegill and Catfish Wet Weights in 4-day Test of Non-food Uptake

Fish Number	Weight gain, d^{-1}
Bluegill	
638 B	---
857 B	0.002
626 U	- 0.004
628 U	- 0.010
638 U	- 0.006
878 U	- 0.004
Avg. B	- 0.001
Avg. U	- 0.007
Catfish	
210.1 B	- 0.009
160.4 B	- 0.012
150.7 B	- 0.006
137.0 U	- 0.002
117.4 U	- 0.010
128.0 U	- 0.018
Avg. B	- 0.009
Avg. U	- 0.010

Table 11a
P-32 Uptake in Worm-fed Bluegill and Catfish
Maintained in Aquaria for Nine Days

Feed %	Temp. C°	Fish No.	Weight Wet	Weight Dry	Weight Ash	Sample No.
			Bluegill Muscle			
1.5	15	1-1	45.3	9.77	596	1198
1.5	15	1-2	29.4	6.40	379	1315
1.5	15	1-3	31.1	6.20	396	1241
1.5	20	2-1	27.4	5.82	327	1289
1.5	20	2-2	25.7	4.92	268	1201
1.5	20	2-3	43.7	9.43	559	1317
3.0	20	3-1	24.6	5.31	307	1262
3.0	20	3-2	24.0	4.14	294	1342
3.0	20	3-3	50.2	11.0	619	1220
1.5	25	4-1	33.9	4.22	287	1215
1.5	25	4-2	27.8	5.39	340	1219
1.5	25	4-3	41.5	8.87	495	1221
2.25	25	5-1	32.3	4.94	263	1242
2.25	25	5-2	33.3	6.94	406	1222
2.25	25	5-3	34.4	7.28	445	1345
3.0	25	6-1	32.8	5.01	310	Lost
3.0	25	6-2	27.5	4.44	222	1195
3.0	25	6-3	25.6	5.30	312	1316
3.0	25	6-4	51.7	11.5	600	1261
			Catfish Muscle			
1.5	25	7-1	92.3	22.9	1,094	1343
1.5	25	7-2	53.6	12.8	603	1287
1.5	25	7-3	51.1	12.1	621	1263
3.0	25	8-1	49.0	11.6	908	1284
3.0	25	8-2	47.8	11.8	540	1243
3.0	25	8-3	48.4	10.7	549	1255

Notes: 1) Exposure period was 01/18-01/27(10) except fish 4-1 was removed on 01/25, 5-1, on 01/26, and 6-1, on 01/20 because of illness, and fish 6-2 was exposed beginning 01/20. 2) Wet and dry wts. are in grams, ash weight is in mg. 3) Duplicate 20-ml aliquots of 100-ml samples were analyzed for P-32 by Cherenkov counting with 50-min. counts when < 200 c/min. and 10-min counts when > 200 c/min. 4) Actual average feed % is given in Table 13a. 5) Average of 2 or more measurements.

Table 11a
P-32 Uptake in Worm-fed Bluegill and Catfish
Maintained in Aquaria for Nine Days

Feed %	Date of counting, 1983(hr)	Decay fraction	Net c/min.	c/min.g. wet	P mg/g	P-32 c/min.mg
	Bluegill Muscle					
1.5	02/08(10)	0.559	1,148.	227.	2.66	85.3
1.5	02/16(13)	0.377	32.9	14.8	2.64	5.6
1.5	02/09(11)	0.531	380.	115.	2.52	45.6
1.5	02/15(05)	0.402	775.	352.	2.35	150.6
1.5	02/07(23)	0.572	39.2	13.3	1.93	6.9
1.5	02/15(23)	0.388	4,126	1217.	2.57	474.
3.0	02/14(20)	0.409	2,325	1,155	2.58	448.
3.0	02/16(08)	0.381	329	180	2.39	75.3
3.0	02/08(23)	0.545	9,772	1,786	2.62	682.
1.5	02/08(13)	0.556	1,305	346	1.82(5)	190.
1.5	02/08(14)	0.554	1,630	529	2.25(5)	235.
1.5	02/08(14)	0.554	1,802	392	2.51	156.
2.25	02/09(12)	0.530	1,683	492	1.33(5)	370.
2.25	02/08(15)	0.554	2,843	771	2.28	338.
2.25	02/21(16)	0.294	1,438	711	2.71	262.
3.0	---	---	---	---	---	---
3.0	02/07(18)	0.577	11.6	3.6	1.31(5)	2.8
3.0	02/15(22)	0.389	1,220	562.	2.21(5)	254.
3.0	02/14(20)	0.409	6,825	1,614	2.49	648.
	Catfish Muscle					
1.5	02/16(08)	0.381	8,663	1,232	2.50	493.
1.5	02/15(05)	0.402	6,454	1,498	2.32	646.
1.5	02/14(21)	0.409	1,926	461	2.26	204.
3.0	02/15(04)	0.403	3,221	816	2.26	361.
3.0	02/09(12)	0.530	7,251	1,431	2.26	633.
3.0	02/14(18)	0.411	9,783	1,907	2.29	833.

Table 11a (cont'd)

P-32 Uptake in Worm-fed Bluegill and Catfish Maintained in Aquaria for Nine Days

Feed %	Temp. C°	Fish No.	Weight Wet	Dry	Ash	Sample No.
			Bluegill Skeleton			
1.5	15	1-1	27.2	8.66	2,310	1207
1.5	15	1-2	23.6	7.49	2,010	1314
1.5	15	1-3	18.5	5.53	1,880	1244
1.5	20	2-1	18.7 ?	6.90	1,560	1291
1.5	20	2-2	18.0	5.59	1,650	1197
1.5	20	2-3	33.4	11.4	3,400	1356
3.0	20	3-1	20.8	6.48	1,840	1275
3.0	20	3-2	21.4	6.00	2,440	1248
3.0	20	3-3	35.0	11.5	2,840	1274
1.5	25	4-1	20.0	5.57	2,040	1203
1.5	25	4-2	15.7	4.90	1,570	1277
1.5	25	4-3	33.9	11.1	2,590	1224
2.25	25	5-1	18.1	5.24	1,890	1240
2.25	25	5-2	23.3	7.61	2,177	1225
2.25	25	5-3	23.6	9.85	2,662	1353
3.0	25	6-1	18.1	4.84	1,760	1176
3.0	25	6-2	12.6	3.75	1,350	1200
3.0	25	6-3	20.8	7.08	2,280	1318
3.0	25	6-4	30.7	9.52	2,280	1286
			Catfish Skeleton			
1.5	25	7-1	38.6	12.7	1,604	1340
1.5	25	7-2	25.5	8.19	874	1323
1.5	25	7-3	34.8	10.9	1,310	1245
3.0	25	8-1	28.9	8.69	1,100	1321
3.0	25	8-2	24.7	8.52	926	1273
3.0	25	8-3	26.7	8.30	945	1352

Table 11a (cont'd)

P-32 Uptake in Worm-fed Bluegill and Catfish
Maintained in Aquaria for Nine Days

Feed %	Date of counting, 1983(hr)	Decay fraction	Net c/min.	c/min.g. wet	P mg/ g wet	P-32 c/min.mg
		Bluegill Skeleton				
1.5	02/08(12)	0.557	1,830	604	14.9	40.5
1.5	02/15(22)	0.389	144	78.4	15.7	5.00
1.5	02/09(12)	0.529	638	326	17.6	18.5
1.5	02/15(06)	0.401	1,061	707	16.0	44.2
1.5	02/07(20)	0.575	44.1	21.3	16.5	1.29
1.5	02/22(12)	0.282	3,269	1,735	19.8	87.6
3.0	02/15(01)	0.406	3,321	1,966	16.1	122
3.0	02/14(16)	0.413	494	279	23.7	11.8
3.0	02/14(24)	0.406	7,363	2,590	15.3	169
1.5	02/08(11)	0.506	1,182	584	19.3	30.3
1.5	02/15(01)	0.406	2,013	1,579	21.3	74.0
1.5	02/08(15)	0.551	3,126	837	15.3	54.7
2.25	02/09(11)	0.531	2,566	1,335	19.5	68.5
2.25	02/08(12)	0.557	4,330	1,668	16.0	104
2.25	02/22(11)	0.283	2,102	1,574	25.4	619
3.0	02/03(05)	0.513	30.7	16.5	20.0	0.825
3.0	02/07(22)	0.573	14.8	10.2	20.9	0.488
3.0	02/15(23)	0.388	1,667	1,033	21.5	48.1
3.0	02/15(04)	0.403	7,474	3,020	15.3	197
		Catfish Skeleton				
1.5	02/16(07)	0.382	4,319	1,465	8.62	170
1.5	02/16(01)	0.386	3,738	1,899	6.51	292
1.5	02/14(12)	0.416	2,149	742	7.73	96.0
3.0	02/15(24)	0.387	2,139	956	7.08	135
3.0	02/14(24)	0.406	4,357	2,170	8.10	268
3.0	02/22(11)	0.283	4,563	3,020	6.43	470

Table 11a (cont'd)

P-32 Uptake in Worm-fed Bluegill and Catfish Maintained in Aquaria for Nine Days

Feed %	Temp. C°	Fish No.	Weight Wet	Dry	Ash	Sample No.
			Bluegill Viscera			
1.5	15	1-1	11.0	2.69	113	1212
1.5	15	1-2	6.27	1.55	67.9	1331
1.5	15	1-3	6.70	130.	77.0	1339
1.5	20	2-1	5.53	1.55	56.3	1298
1.5	20	2-2	5.97	1.25	37.9	1214
1.5	20	2-3	10.1	2.44	110	1299
3.0	20	3-1	7.19	1.63	68.8	1279
3.0	20	3-2	3.68	0.516	47.5	1257
3.0	20	3-3	11.3	3.97	112	1272
1.5	25	4-1	5.17	0.879	39.3	1196
1.5	25	4-2	3.74	1.08	34.1	1235
1.5	25	4-3	8.29	2.56	99.6	1232
2.25	25	5-1	6.45	1.06	52.1	1337
2.25	25	5-2	8.24	1.94	92.7	1234
2.25	25	5-3	8.57	2.08	105	1341
3.0	25	6-1	6.26	0.870	46.6	1178
3.0	25	6-2	3.48	0.738	36.1	1213
3.0	25	6-3	5.30	1.38	73.7	1304
3.0	25	6-4	12.17	4.90	120	1281
			Catfish Viscera			
1.5	25	7-1	19.3	6.23	180	1326
1.5	25	7-2	9.00	3.35	71.5	1333
1.5	25	7-3	12.4	4.95	127	1344
3.0	25	8-1	8.66	3.26	72.4	1305
3.0	25	8-2	9.00	3.37	84.7	1249
3.0	25	8-3	12.0	3.67	115	1332

Table 11a (cont'd)

P-32 Uptake in Worm-fed Bluegill and Catfish Maintained in Aquaria for Nine Days

Feed %	Date of counting, 1983(hr)	Decay fraction	Net c/min.	c/min.g. wet	P, mg/g wet	P-32/P c/min.mg.
			Bluegill Viscera			
1.5	02/08(12)	0.557	4,144	3,380	2.05	1,496
1.5	02/16(04)	0.384	520	1,080	2.26	478(6)
1.5	02/16(07)	0.382	1,553	3,030	2.07	1,464
1.5	02/15(16)	0.393	1,862	4,280	1.81	2,360(6)
1.5	02/08(13)	0.556	546	822	1.24	663(6)
1.5	02/15(17)	0.393	4,346	5,470	1.85	2,960
3.0	02/15(02)	0.405	3,412	5,860	1.65	3,550
3.0	02/14(19)	0.410	610	2,020	1.94	1,041(6)
3.0	02/14(24)	0.406	4,406	4,800	1.74	2,760
1.5	02/08(10)	0.507	707	1,349	1.72	784
1.5	02/09(10)	0.533	1,743	4,370	1.53	2,860(6)
1.5	02/09(09)	0.534	3,310	3,740	1.95	1,918(6)
2.25	02/16(06)	0.383	1,012	2,050	1.58	1,297(6)
2.25	02/09(10)	0.533	4,603	5,240	2.26	2,320
2.25	02/16(08)	0.381	3,881	5,940	2.50	2,380(6)
3.0	02/03(08)	0.509	<2.2	<3.5	1.43	< 2.4
3.0	02/08(20)	0.548	4.8	12.6	2.14	5.9
3.0	02/15(18)	0.392	1,906	4,590	2.81	1,633
3.0	02/15(03)	0.404	6,441	6,550	1.87	3,500
			Catfish Viscera			
1.5	02/16(02)	0.385	4,310	2,900	1.63	1,779
1.5	02/16(05)	0.384	2,151	3,110	1.53	2,030(6)
1.5	02/16(09)	0.380	1,119	1,187	2.51	473(6)
3.0	02/15(19)	0.391	1,403	2,070	1.49	1,389(6)
3.0	02/14(16)	0.413	3,543	4,770	1.92	2,480(6)
3.0	02/16(05)	0.384	5,175	5,620	1.52	3,530(6)

Table 11b
P-32 Uptake in Pellet-fed Catfish and Bluegill
Maintained in Aquaria for Nine Days

Feed %	Temp. C°	Fish No.	Weight Wet	Weight Dry	Weight Ash	Sample No.
			Catfish Muscle			
1.0	15	1-1	51.9	11.0	617	1527
1.0	15	1-2	44.7	10.4	506	1430
1.0	15	1-3	51.0	12.3	580	1530
1.0	20	3-1	51.2	12.2	569	1503
1.0	20	3-2	33.0	7.22	350	1458
1.0	20	3-3	49.0	11.4	575	1382
1.5	20	4-1	51.0	11.6	579	1477
1.5	20	4-2	45.5	10.2	528	1386
1.5	20	4-3	53.3	12.0	590	1531
2.0	20	5-1	52.4	11.7	590	1524
2.0	20	5-2	41.3	9.67	463	1433
2.0	20	5-3	41.8	9.62	470	1529
1.0	25	7-1	54.9	12.6	625	1508
1.0	25	7-2	63.7	13.7	744	1525
1.0	25	7-3	64.3	15.3	734	1523
2.0	25	8-1	51.6	12.3	564	1528
2.0	25	8-2	40.4	9.14	449	1526
2.0	25	8-3	42.6	9.96	464	1381
			Bluegill Muscle			
1.0	20	2-1	27.4	6.21	342	1456
1.0	20	2-2	17.4	3.55	201	1455
1.0	20	2-3	36.2	7.81	455	1457
2.0	20	6-1	21.6	4.40	259	1459
2.0	20	6-2	27.5	5.05	303	1532
2.0	20	6-3	33.3	7.20	424	1460

Notes: 1) Exposure period was 02/08 - 02/17(10).
2) Wet and dry weights are in grams; ash weight is in mg.
3) Duplicate 20-ml aliquots of 100-ml samples were analyzed for P-32 by Cherenkov counting with 50-min counts < 200 c/min and 10-min counts when > 200 c/min.
4) Actual feed % was less for all fish (see Table 13b).
5) Average of 2 or more measurements.

Table 11b
P-32 Uptake in Pellet-fed Catfish and Bluegill
Maintained in Aquaria for Nine Days

Feed %	Date of counting, 1983(hr)	Decay fraction	Net c/min.	c/min.g. wet	P mg/g	P-32 c/min.mg
	Catfish Muscle					
1.0	03/14(18)	0.293	953.	313.	2.65	118.
1.0	03/04(19)	0.475	23.6	5.6	2.15(5)	2.6
1.0	03/12(09)	0.329	28.2	8.4	1.19(5)	7.1
1.0	03/09(04)	0.384	36.4	9.3	2.21	4.2
1.0	03/05(17)	0.454	15.4	5.1	2.19(5)	2.3
1.0	02/25(20)	0.665	31.1	4.8	2.41	2.0
1.5	03/09(09)	0.380	16,161	4,170	2.40	1,738.
1.5	02/28(08)	0.589	16,270	3,036	2.60	1,168
1.5	03/14(19)	0.292	9,049.	2,907	2.37	1,227
2.0	03/14(17)	0.293	2,814	916	2.32	395
2.0	03/07(14)	0.415	6,500	1,896	2.43	780
2.0	03/14(19)	0.292	2,221	910	2.33	391
1.0	03/09(17)	0.374	13,474	3,281	2.34	1,402
1.0	03/14(18)	0.293	5,149	1,379	2.29	602
1.0	03/14(17)	0.293	18,954	5,030	2.30	2,187
2.0	03/14(19)	0.292	7,897	2,621	2.27	1,155
2.0	03/14(18)	0.293	3,026	1,278	2.08(5)	614
2.0	02/28(09)	0.588	6,881	1,374	2.27(5)	605
	Bluegill Muscle					
1.0	03/07(17)	0.412	8,326	3,688	4.02(5)	917
1.0	03/05(15)	0.456	54.1	34.1	2.60	13.1
1.0	03/07(18)	0.411	7,620	2,561	2.51	1,020
2.0	03/05(18)	0.453	171	87.3	2.16	40.4
2.0	03/12(11)	0.327	27.4	15.2	2.37	6.4
2.0	03/07(18)	0.411	18,270	6,675	2.45	2,724

Table 11b (cont'd)
P-32 Uptake in Pellet-fed Catfish and Bluegill Maintained in Aquaria for Nine Days

Feed %	Temp. C°	Fish No.	Weight Wet	Weight Dry	Weight Ash	Sample No.
		Catfish Skeleton				
1.0	15	1-1	26.0	7.25	1,060	1559
1.0	15	1-2	26.0	7.89	937	1383
1.0	15	1-3	22.3	7.49	922	1551
1.0	20	3-1	23.8	7.69	887	1485
1.0	20	3-2	26.5	7.76	844	1490
1.0	20	3-3	19.7	5.91	804	1435
1.5	20	4-1	24.8	8.01	996	1489
1.5	20	4-2	20.7	6.09	762	1434
1.5	20	4-3	27.9	8.23	810	1566
2.0	20	5-1	21.7	6.41	847	1486
2.0	20	5-2	18.2	5.69	736	1432
2.0	20	5-3	24.8	7.54	825	1555
1.0	25	7-1	33.5	10.2	1,010	1484
1.0	25	7-2	40.8	11.2	1,741	1534
1.0	25	7-3	26.2	8.12	985	1561
2.0	25	8-1	25.7	8.61	857	1556
2.0	25	8-2	20.3	6.04	730	1567
2.0	25	8-3	29.8	9.07	997	1431
		Bluegill Skeleton				
1.0	20	2-1	15.1	5.31	1,420	1475
1.0	20	2-2	17.4	5.19	1,670	1492
1.0	20	2-3	21.1	6.76	1,800	1506
2.0	20	6-1	15.4	4.87	1,480	1504
2.0	20	6-2	17.4	5.42	1,730	1554
2.0	20	6-3	18.7	6.22	1,750	1509

Table 11b (cont'd)
P-32 Uptake in Pellet-fed Catfish and Bluegill
Maintained in Aquaria for Nine Days

Feed %	Date of counting, 1983(hr)	Decay fraction	Net c/min.	c/min.g. wet	P mg/ g wet	P-32 c/min.mg
		Catfish Skeleton				
1.0	03/15(01)	0.289	630.	419.	8.66	48.4
1.0	02/25(21)	0.664	17.5	5.1	6.33	0.805
1.0	03/12(21)	0.319	11.9	8.4	8.25	1.02
1.0	03/08(17)	0.393	17.0	9.1	7.76	1.17
1.0	03/08(20)	0.390	18.6	9.0	6.60	1.36
1.0	03/04(21)	0.473	14.8	7.9	8.75	0.903
1.5	03/09(13)	0.377	7,907	4,229	7.26	583
1.5	03/07(14)	0.415	6,273	3,651	6.72	543
1.5	03/15(03)	0.287	5,389	3,365	5.81	579
2.0	03/09(12)	0.378	1,954	1,191	7.27	164
2.0	03/07(13)	0.415	3,824	2,531	6.90	367
2.0	03/14(24)	0.289	1,549	1,081	6.50	166
1.0	03/09(11)	0.379	11,989	4,721	5.90	800
1.0	03/14(20)	0.292	4,218	1,770	8.65	205
1.0	03/15(02)	0.288	10,394	6,887	7.34	938
2.0	03/15(01)	0.289	4,448	2,994	6.95	431
2.0	03/15(04)	0.287	1,606	1,378	6.69	206
2.0	03/07(13)	0.415	4,285	1,732	6.39	271
		Bluegill Skeleton				
1.0	03/09(09)	0.380	5,948	4,748	18.8	252
1.0	03/08(22)	0.389	135	99.7	18.1	5.51
1.0	03/09(16)	0.375	10,305	6,512	13.4	486
2.0	03/09(16)	0.375	251.	217	18.9	11.5
2.0	03/12(24)	0.319	56.2	50.6	18.4	2.75
2.0	03/09(17)	0.374	15,037	10,750	17.3	621

Table 11b (cont'd)
P-32 Uptake in Pellet-fed Catfish and Bluegill
Maintained in Aquaria for Nine Days

Feed %	Temp. C°	Fish No.	Weight Wet	Dry	Ash	Sample No.
			Catfish Viscera			
1.0	15	1-1	12.0	2.52	140	1536
1.0	15	1-2	11.0	3.38	101	1418
1.0	15	1-3	14.8	6.13	111	1498
1.0	20	3-1	10.8	3.86	86.6	1446
1.0	20	3-2	6.53	1.80	54.9	1454
1.0	20	3-3	9.49	3.47	74.4	1416
1.5	20	4-1	13.9	4.08	142	1550
1.5	20	4-2	12.0	4.17	123	1448
1.5	20	4-3	16.3	4.67	178	1515
2.0	20	5-1	11.8	3.63	123	1499
2.0	20	5-2	14.2	4.22	159	1420
2.0	20	5-3	15.5	5.04	166	1537
1.0	25	7-1	12.8	3.04	125	1544
1.0	25	7-2	11.4	2.44	119	1514
1.0	25	7-3	22.3	7.77	272	1463
2.0	25	8-1	15.1	6.17	120	1470
2.0	25	8-2	8.69	2.47	93.4	1548
2.0	25	8-3	13.2	3.96	146	1414
			Bluegill Viscera			
1.0	20	2-1	7.22	2.02	96.7	1465
1.0	20	2-2	3.45	0.624	42.0	1467
1.0	20	2-3	13.0	3.40	201	1469
2.0	20	6-1	4.19	0.911	56.5	1462
2.0	20	6-2	4.40	0.869	48.7	1427
2.0	20	6-3	10.9	3.12	169	1468

Table 11b (cont'd)
P-32 Uptake in Pellet-fed Catfish and Bluegill
Maintained in Aquaria for Nine Days

Feed %	Date of counting, 1983(hr)	Decay fraction	Net c/min.	c/min.g. wet	P, mg/g wet	P-32/P c/min.mg.
		Catfish Viscera				
1.0	03/14(20)	0.292	5,052	7,208	2.26	3,190
1.0	02/27(13)	0.612	32.1	23.8	1.96	12.1(6)
1.0	03/09(01)	0.386	42.8	37.5	1.77	21.2(6)
1.0	03/05(05)	0.465	14.4	14.3	1.60	8.9(6)
1.0	03/05(13)	0.458	6.6	11.0	1.63	6.7(6)
1.0	02/27(10)	0.616	41.1	35.2	1.57	22.4(6)
1.5	03/14(24)	0.289	7,828	9,743	1.87	5,210
1.5	03/07(17)	0.412	6,837	6,914	1.59	4,350
1.5	03/09(19)	0.373	8,021	6,596	2.21	2,990(6)
2.0	03/09(15)	0.376	2,231	2,514	2.60	965(6)
2.0	02/27(18)	0.606	13,271	7,711	1.94	3,970
2.0	03/14(21)	0.291	4,520	5,011	2.05	2,440
1.0	03/14(22)	0.291	5,953	7,991	1.63	4,900
1.0	03/09(19)	0.373	5,866	6,898	1.74	3,970
1.0	03/07(19)	0.410	16,488	9,017	2.61	3,460
2.0	03/07(21)	0.409	4,818	3,901	1.32	2,950
2.0	03/14(23)	0.290	2,925	5,803	1.96	2,960(6)
2.0	02/28(13)	0.583	8,330	5,412	2.24	2,420(6)
		Bluegill Viscera				
1.0	03/07(19)	0.410	10,098	17,060	2.10	8,120
1.0	03/05(22)	0.450	301	969	2.20	440
1.0	03/07(20)	0.410	22,769	21,360	2.51	8,510
2.0	03/07(18)	0.411	1,220	3,542	2.27	1,559(6)
2.0	03/04(16)	0.478	198	471	2.33	202(6)
2.0	03/07(20)	0.410	20,648	23,100	2.58	8,950

Table 12a
P-32 Concentration in Worms Fed to Bluegill & Catfish

Feeding Date, 1983	Amount fed, g	Vial No.	Weight, mg		No. of worms
			Dry	Ash	
01/18	64.5	1360	207	14.6	4
		1361	263	16.2	8
01/19	62.8	1362	297	18.7	8
		1363	295	18.8	6
01/20	67.0	1364	264	16.2	8
		1365	318	18.4	8
01/21	71.5	1366	259	15.2	6
		1367	335	18.5	9
01/22	64.2	1368	285	16.4	9
		1369	267	13.5	6
01/23	61.2	1370	256	15.8	9
01/24	68.5	1371	251	14.0	11
01/25	68.5	1372	271	14.8	5
		1373	315	18.6	9
01/26	68.5	1374	272	14.7	8
		1375	310	16.3	8

Notes: 1) Feed samples were 2 g moist weight; 20-ml aliquots of 100-ml samples were counted.
2) Amount fed is moist weight; amount of feed was based on fish weight.
3) P-32 added to worm feed was 3.21×10^5 c/min.g worm wet weight

Table 12a
P-32 Concentration in Worms Fed to Bluegill & Catfish

Feeding Date, 1983	Counting date, 1983 (hr)	Decay factor	P-32 net c/min.	P-32 c/min. g	P mg/g wet wt.	P-32/P c/min.mg.
01/18	02/22(13)	0.182	356	4,890	0.895	5,464
	02/22(13)	0.182	759	10,430	1.13	9,230
01/19	02/22(14)	0.191	2,298	30,080	1.23	24,455
	02/22(14)	0.191	2,173	28,440	1.23	23,122
01/20	02/22(14)	0.200	1,500	18,750	1.10	17,045
	02/22(15)	0.200	1,571	19,640	1.27	15,465
01/21	02/22(15)	0.210	1,885	22,440	1.00	22,440
	02/22(15)	0.210	1,979	23,560	1.38	17,072
01/22	02/22(16)	0.220	2,441	27,740	1.23	22,553
	02/22(16)	0.220	1,566	17,800	1.03	17,282
01/23	02/23(07)	0.224	1,194	13,330	1.06	12,575
01/24	02/23(07)	0.235	1,385	14,730	1.00	14,730
01/25	02/23(08)	0.246	1,900	19,310	1.11	17,396
	02/23(08)	0.246	2,233	22,690	1.25	18,152
01/26	02/23(08)	0.258	1,541	14,930	1.12	13,330
	02/23(09)	0.258	1,812	17,560	1.34	13,104

Table 12b
P-32 Concentration in Pellets
Fed to Bluegill & Catfish

Feeding Date, 1983	Amount fed, g	Vial No.	Weight, mg Dry	Ash
02/08	12.3	1568	545	58.5
		1569	579	60.9
02/09	12.3	1570	477	51.2
		1571	561	59.6
02/10	12.3	1572	565	53.8
		1573	638	68.0
02/11	12.3	1574	535	53.8
		1575	608	64.3
02/12	12.3	1576	563	58.5
		1577	665	68.6
02/13	12.3	1578	491	51.4
		1579	422	45.2
02/14	24.5	1580	426	44.8
		1581	689	74.7
02/15	37.0	1582	588	58.5
		1583	660	69.1
02/16	37.0	1584	603	61.5
		1585	721	73.2

Notes: 1. Feed samples were dry weight as shown; 20-ml aliquots of 100-ml samples were counted.
2. Amount fed is dry weight; amount of feed was based on fish weight.
3. P-32 added was 3.36×10^5 c/min.g pellet.

Table 12b
P-32 Concentration in Pellets Fed to Bluegill & Catfish

Feeding Date, 1983	Counting date, 1983 (hr)	Decay factor	P-32 net c/min.	P-32 c/min. g	P mg/g wet wt.	P-32/P c/min.mg
02/08	03/18(10)	0.159	5,053	291,600	13.3	21,900
	03/18(11)	0.158	5,545	301,400	12.9	23,400
02/09	03/18(11)	0.166	4,856	306,700	13.6	22,600
	03/18(11)	0.166	5,546	297,700	13.5	22,100
02/10	03/18(12)	0.174	5,934	301,800	14.0	21,600
	03/18(12)	0.174	6,258	281,900	14.8	19,000
02/11	03/18(12)	0.183	5,699	291,000	13.2	22,000
	03/18(13)	0.182	6,770	305,900	14.2	21,500
02/12	03/18(13)	0.191	6,615	307,600	13.9	22,100
	03/18(13)	0.191	7,395	291,100	14.1	20,600
02/13	03/18(14)	0.200	6,048	307,900	14.2	21,700
	03/18(14)	0.200	5,255	311,400	13.9	22,400
02/14	03/18(14)	0.210	5,409	302,300	12.1	25,000
	03/18(15)	0.210	8,723	301,500	13.0	23,000
02/15	03/18(15)	0.220	7,626	294,700	29.8	
	03/18(15)	0.220	8,601	296,200	15.7	18,900
02/16	03/18(16)	0.231	8,413	302,000	12.9	23,400
	03/18(16)	0.231	9,733	292,200	13.5	21,600

Table 13a

Fish Weights and Amount Fed (Worms)

Tank No.	Fish No.	Comments(1)	Fish wt., g Start	End	Amount fed, g	Feeding ratio, g/d. 100 g.wt.
	1-1	---	150.0	149.3		
1(B)	1-2	---	118.0	111.0	28.8	0.87
	1-3	---	107.0	107.9		
	2-1	2	103.1	88.8		
2(B)	2-2	3	107.6	91.2	49.4	1.61
	2-3	1 01/19-22	161.2	161.2		
	3-1	---	99.3	91.0		
3(B)	3-2	---	109.0	97.6	95.4	2.93
	3-3	1	167.0	172.8		
	4-1	---	106.7	110.0		
4(B)	4-2	---	98.8	87.8	47.6	1.53
	4-3	1	154.3	147.6		
	5-1	2	129.3	111.7		
5(B)	5-2	1	104.1	122.0	82.8	2.42
	5-3	3 01/23-25	173.4	146.3		
	6-1	---	73.0	74.3		
6(B)	6-2	---	95.0	100.3	91.1	2.94
	6-3	---	164.6	169.1		
	7-1		271.0	262.4		
7(C)	7-2		160.0	152.5	75.5	1.45
	7-3		169.0	160.6		
	8-1		167.1	156.1		
8(C)	8-2		155.0	147.6	126.1	3.01
	8-3		169.0	161.2		

B: bluegills; C: catfish

(1) Number indicated order of feeding and/or territorial dominance determined by observation; date refers to period for which fish was isolated by screen. Isolated fish were fed approximately one-third of daily feed.

Table 13a cont'd

Fish Weights and Amount of Worms Fed in Aquaria

Fish Number	Weight gain, d^{-1}
1-1	0.000
1-2	- 0.007
1-3	0.001
Avg.	- 0.002
2-1	- 0.017
2-2	- 0.018
2-3	0.000
Avg.	- 0.012
3-1	- 0.001
3-2	- 0.012
3-3	0.004
Avg.	- 0.003
4-1	0.004
4-2	- 0.013
4-3	- 0.005
Avg.	- 0.005
5-1	- 0.016
5-2	0.017
5-3	- 0.019
Avg.	- 0.006
6-2	0.002
6-3	0.006
6-4	0.003
Avg.	0.004
7-1	- 0.004
7-2	- 0.005
7-3	- 0.006
Avg.	- 0.005
8-1	- 0.008
8-2	- 0.005
8-3	- 0.005
Avg.	- 0.006

Table 13b

Fish Weights and Amount Fed (Pellets)

Tank No.	Fish No.	Comments(1)	Fish wt., g Start	End	Amount fed, g	Feeding ratio, g/d. 100 g.wt.
	1-1		166.0	163.0		
1(C)	1-2		158.0	148.0	16.8	0.41
	1-3		158.0	149.6		
	2-1	3	---	86.5		
2(B)	2-2	2	---	80.2	10.5	0.41
	2-3	1 02/07-17	104.5	115.8		
	3-1		178.5	150.5		
3(C)	3-2		137.5	118.2	17.7	0.48
	3-3		169.0	140.8		
	4-1		150.0	154.8		
4(C)	4-2		133.7	134.6	25.0	0.62
	4-3		173.0	163.2		
	5-1		163.0	148.5		
5(C)	5-2		122.3	126.4	32.8	0.88
	5-3		141.5	140.0		
	6-1	---	86.5	75.6		
6(B)	6-2	---	94.4	86.2	19.0	0.79
	6-3	1	94.5	105.7		
	7-1		182.0	181.4		
7(C)	7-2		210.0	212.4	17.5	0.34
	7-3		171.0	180.0		
	8-1		165.0	171.5		
8(C)	8-2		146.0	133.7	32.3	0.80
	8-3		152.5	146.3		

B: bluegill; C: catfish

(1) Number indicated order of feeding and/or territorial dominance determined by observation; date refers to period for which fish was isolated by screen. Isolated fish was fed approximately one-third of daily feed.

Table 13b cont'd

Fish Weights and Amount of Pellets Fed in Aquaria

Fish Number	Weight gain, d^{-1}
1-1	- 0.002
1-2	- 0.007
1-3	- 0.006
Avg.	- 0.005
2-1	---
2-2	---
2-3	0.011
Avg.	
3-1	- 0.019
3-2	- 0.017
3-3	- 0.020
Avg.	- 0.019
4-1	0.003
4-2	0.001
4-3	- 0.005
Avg.	0.000
5-1	- 0.010
5-2	0.004
5-3	- 0.001
Avg.	- 0.002
6-1	- 0.015
6-2	- 0.010
6-3	0.012
Avg.	- 0.004
7-1	0.000
7-2	0.001
7-3	0.006
Avg.	0.002
8-1	0.004
8-2	- 0.010
8-3	- 0.005
Avg.	- 0.004

Table 17a

Pellet Contents Reported by Supplier

Element	%
Na	0.5
K	0.9
Mg	0.2
Ca	1.6
P	1.0
Cl	0.9

Notes:
1. Pellets are Purina Trout Chow L.F., purchased July 17, 1982.
2. Values are approximations based on ingredients.
3. Basis is "dry weight" which is 90% dry matter.

Table 17b

Phosphate Concentration in Atlanta Water
Reported by Treatment Plant

Month	Water plant sample, mg/L	Distribution system sample, mg/L
Nov. 82	0.68 (0.07 - 1.60)[1]	0.45 (Nov. 22)[2]
Dec. 82	0.49 (0.26 - 0.74)	0.38 (Dec. 30)
Jan. 83	0.43 (0.11 - 0.78)	0.48 (Jan. 31)
Feb. 83	0.70 (0.45 - 0.85)	0.44 (March 1)

Notes: (1) average of daily values (range in parentheses)
(2) collected at indicated date from nearest sampling point (Luckie and Hunnicutt Sts.) to Georgia Tech

Table 18a

Average Specific Activity in Tissue Relative to Feed for Bluegill in Flow-through Tank (East)

Date, 1982	Interval, days(1)	Muscle	Skeleton	Viscera
09/28	1	0.65 ± 0.24(2, 3)	0.27 ± 0.15(2, 3)	7.8 ± 0.8(2, 3)
09/29	2	5.8 ± 1.9	1.5 ± 0.4	110 ± 40
09/30	3	7.3 ± 3.8	1.5 ± 0.6	140 ± 80
10/06	9	29 ± 4	3.7 ± 0.5	270 ± 60
10/12	15	51 ± 13	6.6 ± 2.5	170 ± 20
10/19	22	50 ± 4	8.0 ± 3.2	120 ± 30
10/26	29	42 ± 17	6.6 ± 2.7	170 ± 60
11/03	37	49 ± 8	10.3 ± 2.3	200 ± 20
11/09	43	42 ± 6	7.6 ± 2.8	170 ± 30
11/17	51(0)	49 ± 10	9.3 ± 3.0	190 ± 60
11/20	(3)	65 ± 26	8.1 ± 1.9	116 ± 11
11/24	(7)	50 ± 6	6.0 ± 0.9	82 ± 4
11/30	(13)	30 ± 4	3.7 ± 0.7	39 ± 4
12/07	(20)	16 ± 4	3.2 ± 1.5	22 ± 4
12/15	(28)	15 ± 1	1.7 ± 0.3	10.6 ± 1.2

Notes:
1. Days in parentheses refer to depuration period.
2. Divide all values of c/min.g tissue ÷ c/min.g feed by 1,000.
3. ± value is estimated standard deviation of mean for 3 fish tissue values [0.59 x range/$(3)^{0.5}$] combined with standard deviation of mean for 41 bluegill feed values (370 c/min.g) or for 5 catfish feed values (300 c/min.g).
4. Specific activity ratios in parentheses were not utilized because of large weight losses by fish; if only one of three fish lost weight, the next value shown is the average for two fish.

Table 18b

Average Specific Activity in Tissue Relative to Feed for Bluegill in Flow-through Tank (West)

Date, 1982	Interval, days	Muscle	Skeleton	Viscera
09/28	1	5.6 ± 1.1	1.2 ± 0.3	210 ± 70
09/29	2	13.3 ± 1.0	3.1 ± 0.2	190 ± 20
09/30	3	11.0 ± 0.8	2.1 ± 0.3	350 ± 30
10/06	9	32 ± 4	8.5 ± 0.8	340 ± 40
10/12	15	47 ± 17	8.6 ± 3.0	260 ± 20
10/19	22	69 ± 12	14 ± 2	200 ± 10
10/26	29	76 ± 16	10.0 ± 0.8	210 ± 20
11/03	37	50 ± 13	8.3 ± 3.0	200 ± 20
11/09	43	70 ± 17	8.0 ± 2.4	180 ± 40
11/17	51(0)	72 ± 13	13 ± 3	210 ± 20
11/20	(3)	54 ± 9	11 ± 2	120 ± 20
11/24	(7)	56 ± 11	7.1 ± 1.5	94 ± 7
11/30	(13)	48 ± 8	11 ± 3	53 ± 4
12/07	(20)	25 ± 2	5.6 ± 1.7	29 ± 2
12/15	(28)	18 ± 4	3.7 ± 0.4	14 ± 1

Table 18c

Average Specific Activity in Tissue Relative to Feed for Catfish in Flow-through Tank (East)

Date, 1982	Interval, days	Muscle	Skeleton	Viscera
08/16	1	16 ± 10	3.7 ± 1.7	150 ± 80
08/17	2	9 ± 5	1.9 ± 0.8	48 ± 14
08/18	3	21 ± 7	6.1 ± 1.2	190 ± 70
08/24	9	(83 ± 38)(4)	(25 ± 10)	(340 ± 130)
		110 ± 25	34 ± 3	450 ± 60
08/26	11	77 ± 18	24 ± 6	320 ± 20

Table 18d

Average Specific Activity in Tissue Relative to Feed for Catfish in Flow-through Tank (West)

Date, 1982	Interval, days	Muscle	Skeleton	Viscera
08/16	1	(0.25 ± 0.06)	(0.05 ± 0.03)	(<0.3)
08/17	2	(3.7 ± 2.3)	(1.3 ± 1.1)	(20 ± 16)
		5.2 ± 1.7	2.0 ± 1.0	30 ± 13
08/18	3	10.3 ± 3.1	2.8 ± 0.8	56 ± 18
08/24	9	57 ± 33	12.0 ± 6.0	320 ± 100
08/26	11	77 ± 36	15.0 ± 7.0	250 ± 100

Table 19a

Phosphorus Biological Turnover Rate Constant for Worm-fed Bluegill in Flow-through System (East) Based on Accumulation

Interval, days	Muscle, day^{-1}	Skeleton, day^{-1}	Viscera, day^{-1}
1	0.0006(1)	0.00027	0.0080
2	0.0031	0.00080	0.061(3)
3	0.0026	0.00054	0.054(3)
9	0.0040	0.00051	0.044(3)
15	0.0049	0.00062	0.0179
22	0.0038	0.00059	0.0097
29	0.0028	0.00043	0.0125
37	0.0030	0.00060	0.0138
43	0.0024	0.00042	0.0109
51	0.0027	0.00050	0.0120
Avg. S.D.M.(2)	0.0030 ± 0.0003	0.00053 ± 0.00004	0.0121 ± 0.0013
$t_{1/2}$, days	230 ± 23	1,300 ± 100	57 ± 6
Br/B	0.058 ± 0.006	0.011 ± 0.001	0.20 ± 0.02

(1) Biological turnover rate constant is determined by trial and error substitution in exponent:

$$\lambda_b = \frac{\lambda_r}{\{1 - e^{-(\lambda_r + \lambda_b)t}\} S/S_f - 1}$$

(2) S.D.M.: Standard deviation of the mean value

(3) Excluded from average

Table 19b

Phosphorus Biological Turnover Rate Constant for Worm-fed Bluegill in Flow-through System (West) Based on Accumulation

Interval, days	Muscle, day^{-1}	Skeleton, day^{-1}	Viscera, day^{-1}
1	0.0058	0.00123	0.24(3)
2	0.0070	0.00163	0.111(3)
3	0.0039	0.00075	0.156(3)
9	0.0045	0.00118	0.059(3)
15	0.0045	0.00081	0.030(3)
22	0.0054	0.00105	0.0172
29	0.0052	0.00065	0.0160
37	0.0030	0.00048	0.0138
43	0.0041	0.00044	0.0117
51	0.0041	0.00070	0.0136
Avg. S.D.M.	0.0048 ± 0.0003	0.00089 ± 0.00012	0.0145 ± 0.0010
$t_{1/2}$, days	140 ± 10	780 ± 110	46 ± 3
Br/B	0.090 ± 0.006	0.018 ± 0.002	0.23 ± 0.02

Table 19c

Phosphorus Biological Turnover Rate Constant for Pellet-fed Catfish in Flow-through System (East) Based on Accumulation

Interval, days	Muscle, day^{-1}	Skeleton, day^{-1}	Viscera, day^{-1}
1	0.0165	0.0038	0.167
2	0.0047	0.0010	0.026
3	0.0076	0.0022	0.076
9	0.0161	0.0048	0.086
11	0.0094	0.0029	0.047
Avg. S.D.M.	0.0109 ± 0.0023	0.0029 ± 0.0002	0.080 ± 0.024
$t_{1/2}$, days	64 ± 14	240 ± 20	8.7 ± 2.6
Br/B	0.18 ± 0.04	0.056 ± 0.005	0.62 ± 0.49

Table 19d

Phosphorus Biological Turnover Rate Constant for Pellet-fed Catfish in Flow-through System (West) Based on Accumulation

Interval, days	Muscle, day^{-1}	Skeleton, day^{-1}	Viscera, day^{-1}
1	----	----	----
2	0.0027	0.0007	0.016
3	0.0037	0.0010	0.021
9	0.0080	0.0017	0.054
11	0.0094	0.0018	0.035
Avg. S.D.M.	0.0060 ± 0.0016	0.0013 ± 0.0003	0.032 ± 0.008
$t_{1/2}$, days	120 ± 32	530 ± 110	22 ± 6
Br/B	0.11 ± 0.03	0.026 ± 0.005	0.40 ± 0.11

Table 20

Phosphorus Biological Turnover Rate Constant for Worm-fed Bluegill in Flow-through Tanks Based on Depuration

	Group	Muscle	Skeleton	Viscera
Mean total turnover rate constant, day^{-1}	East	0.055	0.059	0.101
	West	0.049	0.040	0.092
Biological turnover rate constant, day^{-1}	East	0.007	0.011	0.053
	West	0.001	---	0.044
Correlation coefficient	East	0.94	0.990	0.996
	West	0.97	0.89	0.996
Relative specific activity ratio, beginning of depuration	East	0.062	0.0092	0.167
	West	0.072	0.0141	0.182

(1) Values are calculated by linear regression analysis of average specific activity ratios for samples collected on 6 days during depuration.
(2) Biological turnover rate is mean total turnover rate - 0.0485 day^{-1}.

Table 21a

Specific Activity in Tissue Relative to Food in Fish
Maintained 9 Days in Aquaria: Muscle

Feed, per 100 g fish per day			Temperature, °C		
Worms, g moist	Pellets, g dry	P, mg	15	20	25
0.9	---	1.1	0.003 ± 0.002(1, 4)	----	----
1.4 - 1.6	---	1.7 - 2.0	----	0.013 ± 0.010(1) (0.029)(3)	0.012 ± 0.002 0.027 ± 0.009(2)
2.4	---	3.0	----	----	0.020 ± 0.003
2.9 - 3.0	---	3.6 - 3.7	----	0.024 ± 0.013(1) (0.032)	0.018 ± 0.013 0.036 ± 0.010(1)
---	0.3 - 0.5	4.1 - 6.8	0.002 ± 0.002(1)	0.030 ± 0.016 0.063 ± 0.009 <0.001(1)	0.064 ± 0.025
---	0.8 - 1.0	10.9 - 13.6	----	0.042 ± 0.042(1) 0.024 ± 0.006	0.036 ± 0.009(1) (0.057)
---	2.0	27.2	----	----	(0.082)

(1) Low value associated with fish weight loss
(2) Values for catfish are underlined
(3) Values in parentheses are calculated from measurements in large tanks
(4) Means of triplicate values are given; ± values are 0.591 $R/3^{0.5}$, where R is the range of triplicate values

Table 21b

Specific Activity in Tissue Relative to Food in Fish
Maintained 9 Days in Aquaria: Skeleton

Feed, per 100 g fish per day			Temperature, °C		
Worms, g moist	Pellets, g dry	P, mg	15	20	25
0.9	---	1.1	0.0013 ± 0.0007(1)	----	----
1.4 - 1.6	---	1.7 - 2.0	----	0.003 ± 0.002(1) (0.004)	0.003 ± 0.001 0.012 ± 0.004
2.4	---	3.0	----	----	0.005 ± 0.001
2.9 - 3.0	---	3.6 - 3.7	----	0.006 ± 0.003(1) (0.008)	0.005 ± 0.004 0.018 ± 0.007
---	0.3 - 0.5	4.1 - 6.8	0.0008 ± 0.0008(1)	0.011 ± 0.007 0.026 ± 0.001 <0.0001(1)	0.030 ± 0.012
---	0.8 - 1.0	10.9 - 13.6	----	0.010 ± 0.010(1) 0.011 ± 0.002	0.014 ± 0.004(1) (0.012)
---	2.0	27.2	----	----	(0.025)

Table 21c

Specific Activity in Tissue Relative to Food in Fish
Maintained 9 Days in Aquaria: Viscera

Feed, per 100 g fish per day			Temperature, °C		
Worms, g moist	Pellets, g dry	P, mg	15	20	25
0.9	---	1.1	0.07 ± 0.02	----	----
1.4 - 1.6	---	1.7 - 2.0	----	0.12 ± 0.05(1) (0.027)	0.11 ± 0.04 0.09 ± 0.03
2.4	---	3.0	----	----	0.12 ± 0.02
2.9 - 3.0	---	3.6 - 3.7	----	0.15 ± 0.05 (0.34)	0.10 ± 0.07 0.15 ± 0.05(1)
---	0.3 - 0.5	4.1 - 6.8	0.05 ± 0.05(1)	0.26 ± 0.13 0.19 ± 0.04 <0.001(1)	0.19 ± 0.03
---	0.8 - 1.0	10.9 - 13.6	----	0.16 ± 0.13 0.11 ± 0.05	0.13 ± 0.01 (0.32)
---	2.0	27.2	----	----	(0.34)

Table 22

Specific Activity in Tissue Relative to Water for Unfed Fish Maintained 4 Days in Aquaria

Species	Treatment	Muscle	Skeleton	Viscera
Bluegill	Blocked	0.18 ± 0.01(1)	0.10 ± 0.02	8.8 ± 0.6
	Control	0.08 ± 0.03	0.05 ± 0.03	4.7 ± 2.5
Catfish	Blocked	0.18 ± 0.02	0.12 ± 0.01	1.2 ± 0.6
	Control	0.10 ± 0.01	0.05 ± 0.01	1.1 ± 0.3
Bluegill fed worms in flow-through tanks (2)		11	2.0	160

(1) Divide all values by 1,000
(2) Worm-fed bluegill ratios were interpolated for 4th day from Figs. 1a, 1c, and 1e

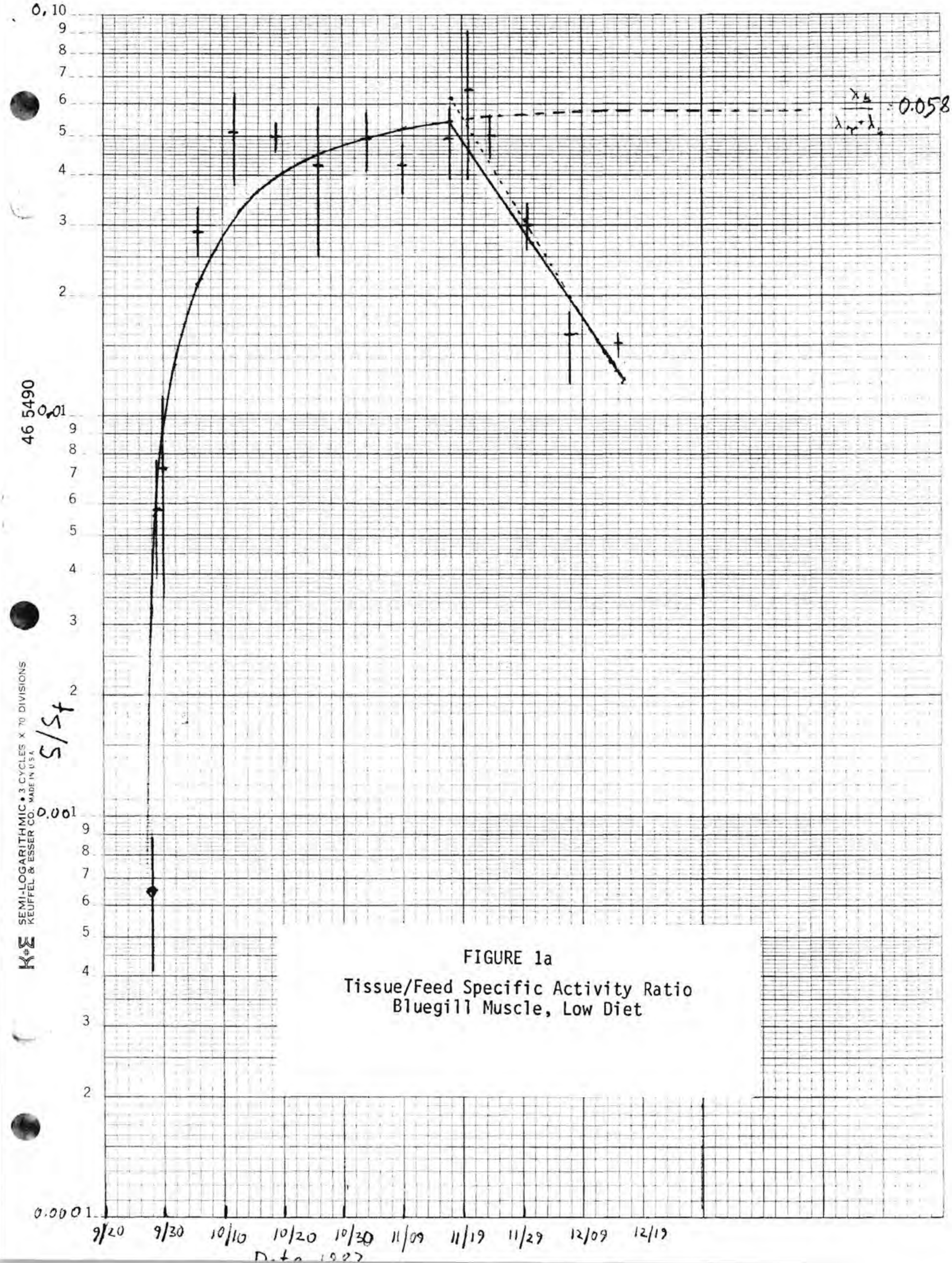

FIGURE 1a

Tissue/Feed Specific Activity Ratio
Bluegill Muscle, Low Diet

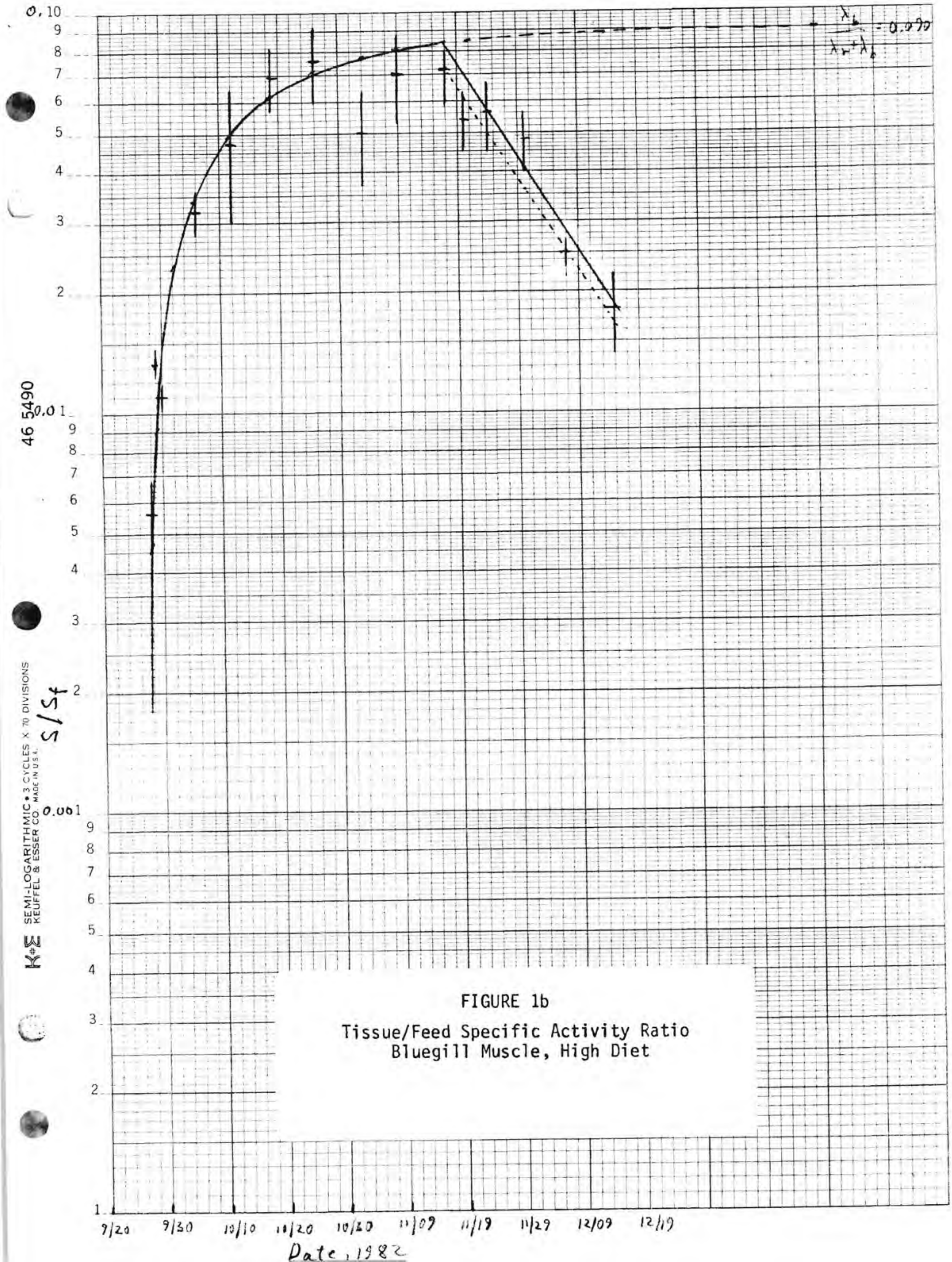

FIGURE 1b

Tissue/Feed Specific Activity Ratio
Bluegill Muscle, High Diet

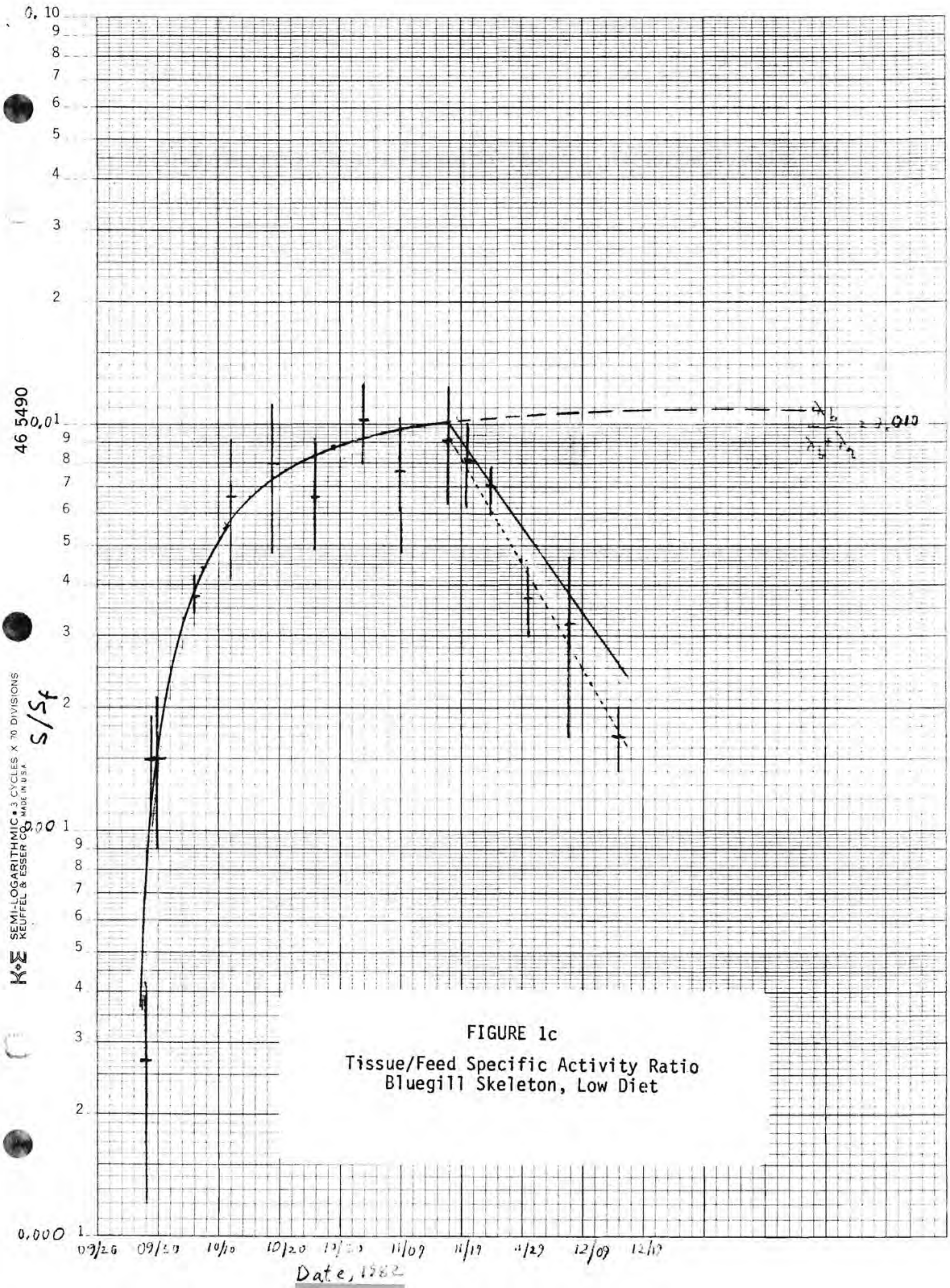

FIGURE 1c

Tissue/Feed Specific Activity Ratio
Bluegill Skeleton, Low Diet

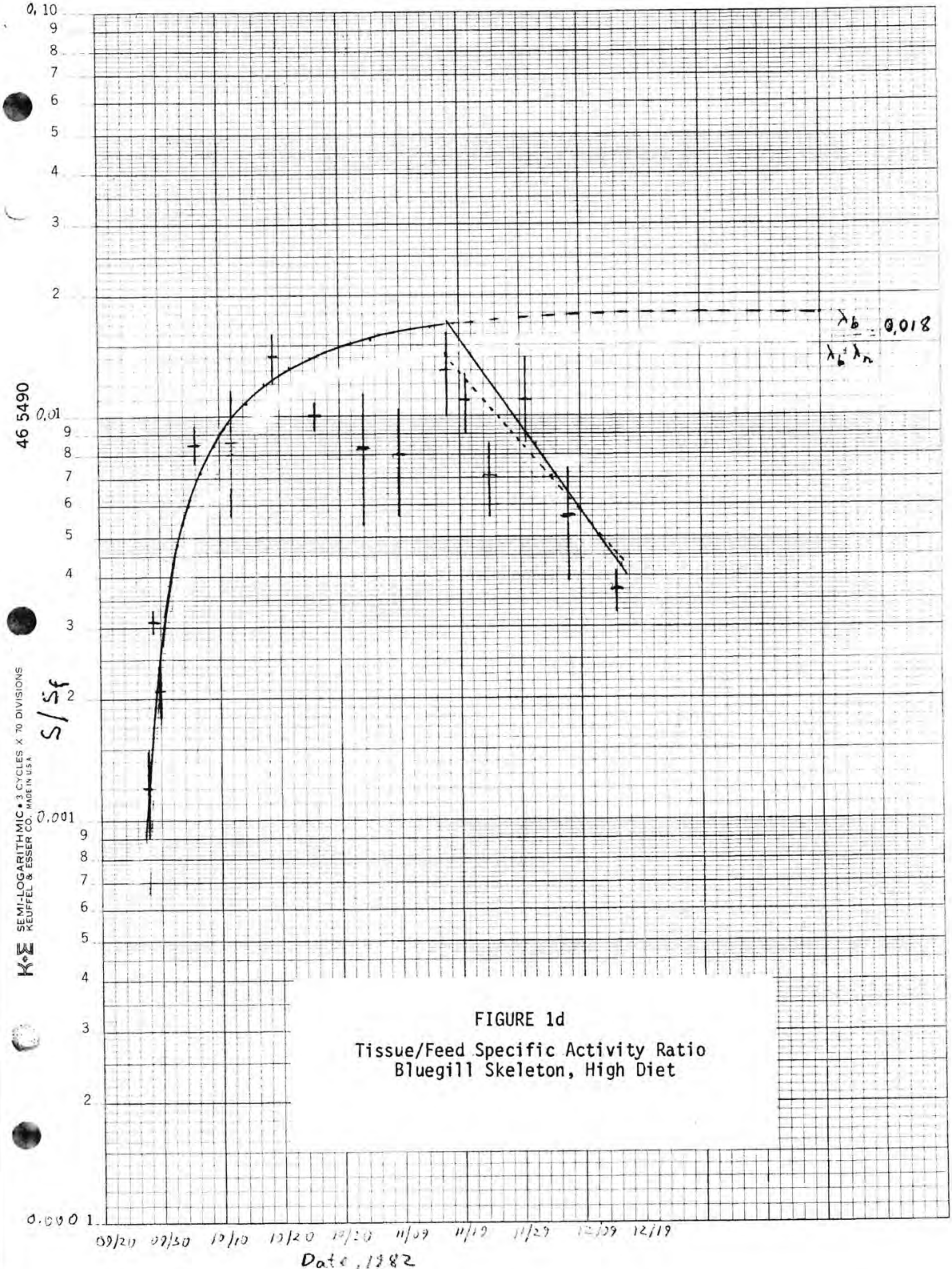

FIGURE 1d

Tissue/Feed Specific Activity Ratio
Bluegill Skeleton, High Diet

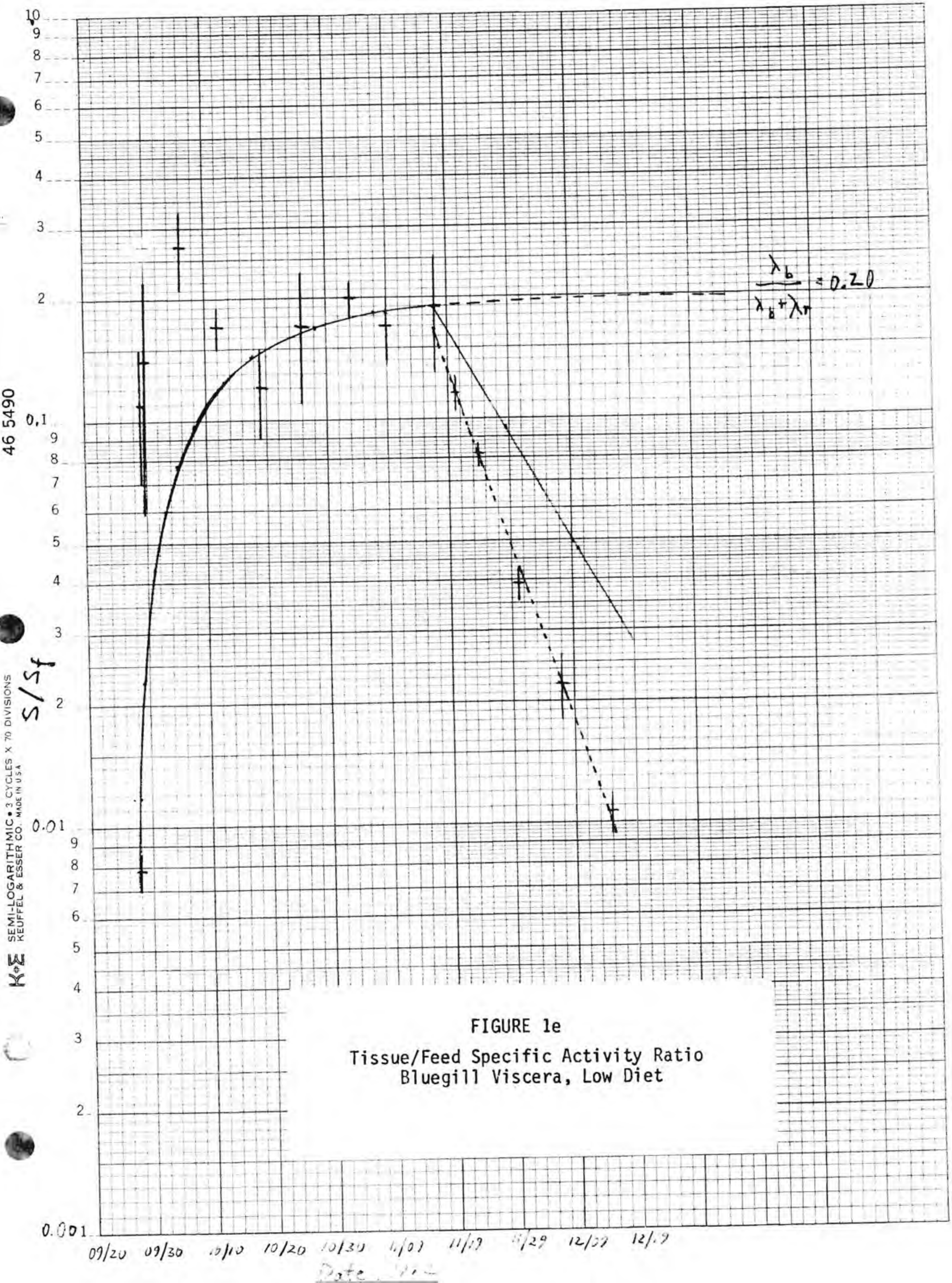

FIGURE 1e

Tissue/Feed Specific Activity Ratio
Bluegill Viscera, Low Diet

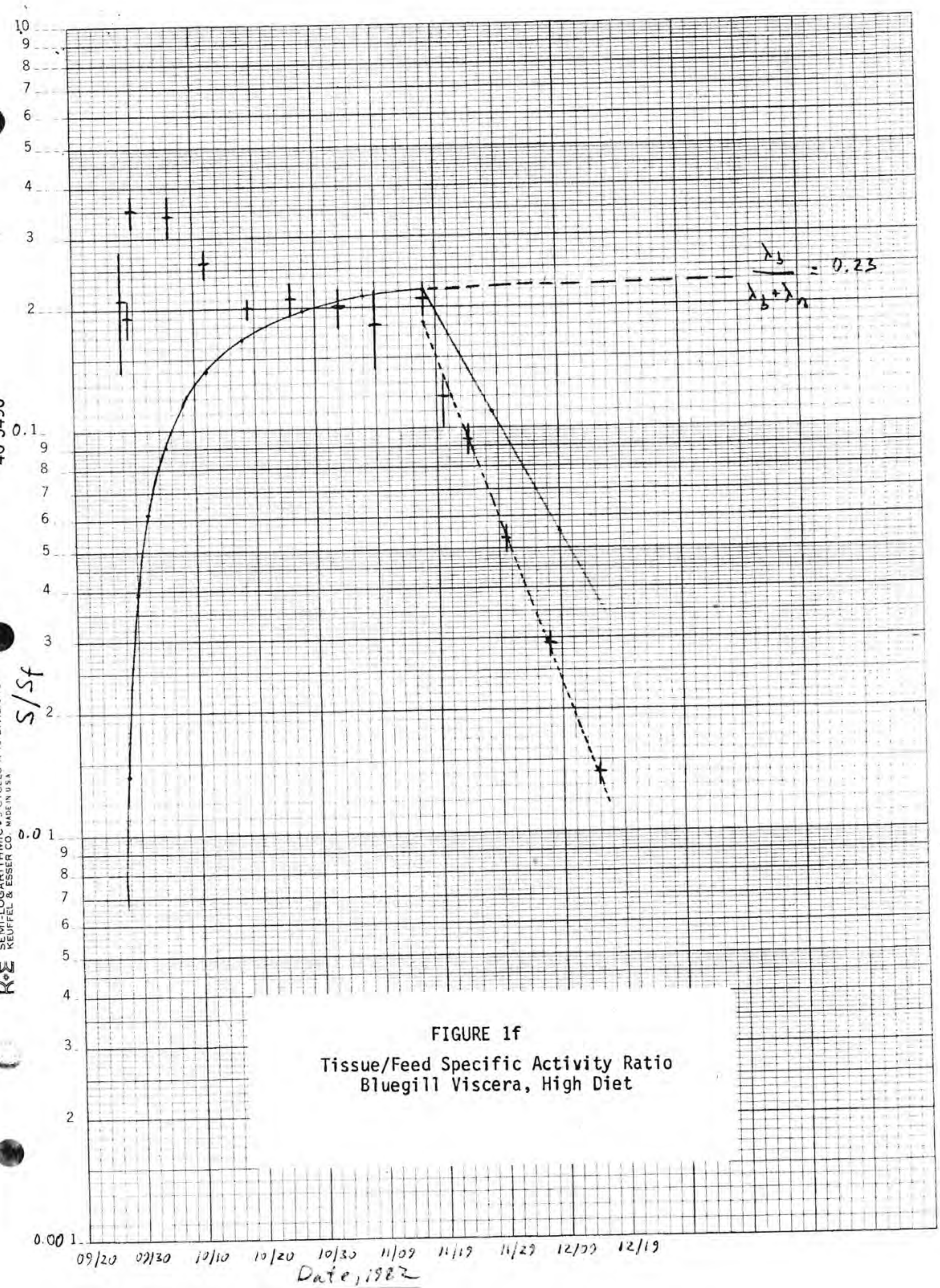

FIGURE 1f

Tissue/Feed Specific Activity Ratio
Bluegill Viscera, High Diet

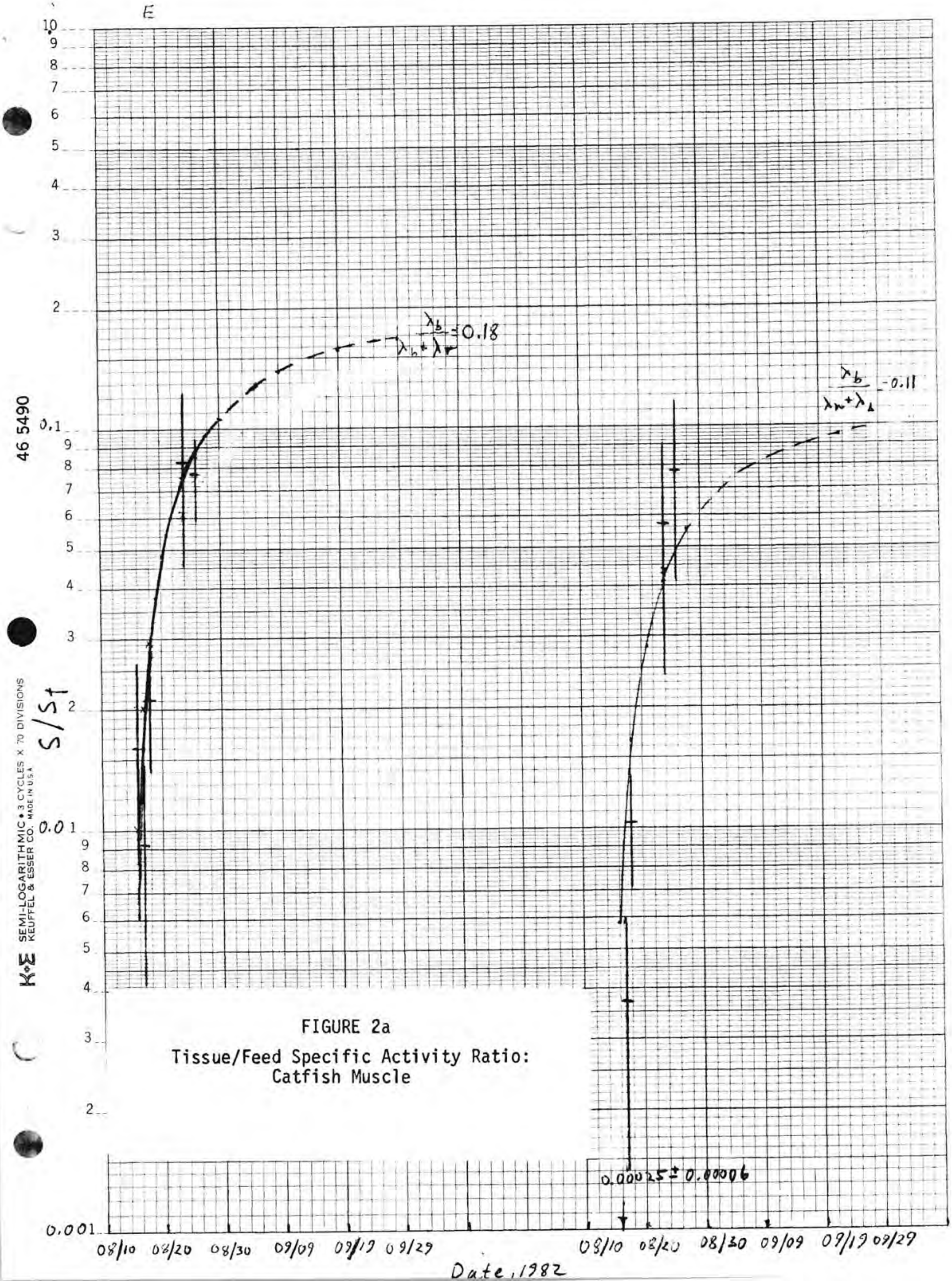

FIGURE 2a

Tissue/Feed Specific Activity Ratio: Catfish Muscle

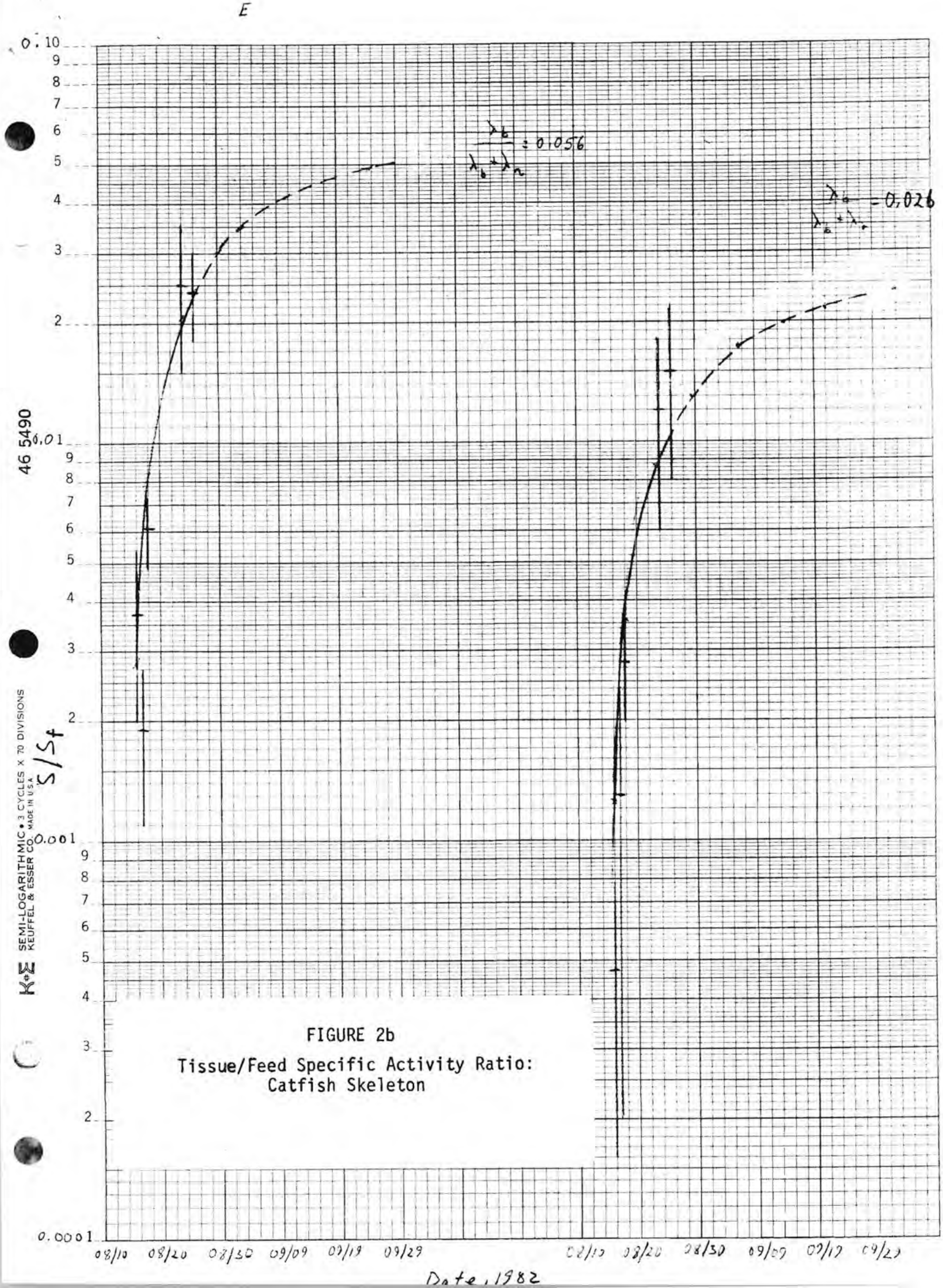

FIGURE 2b

Tissue/Feed Specific Activity Ratio:
Catfish Skeleton

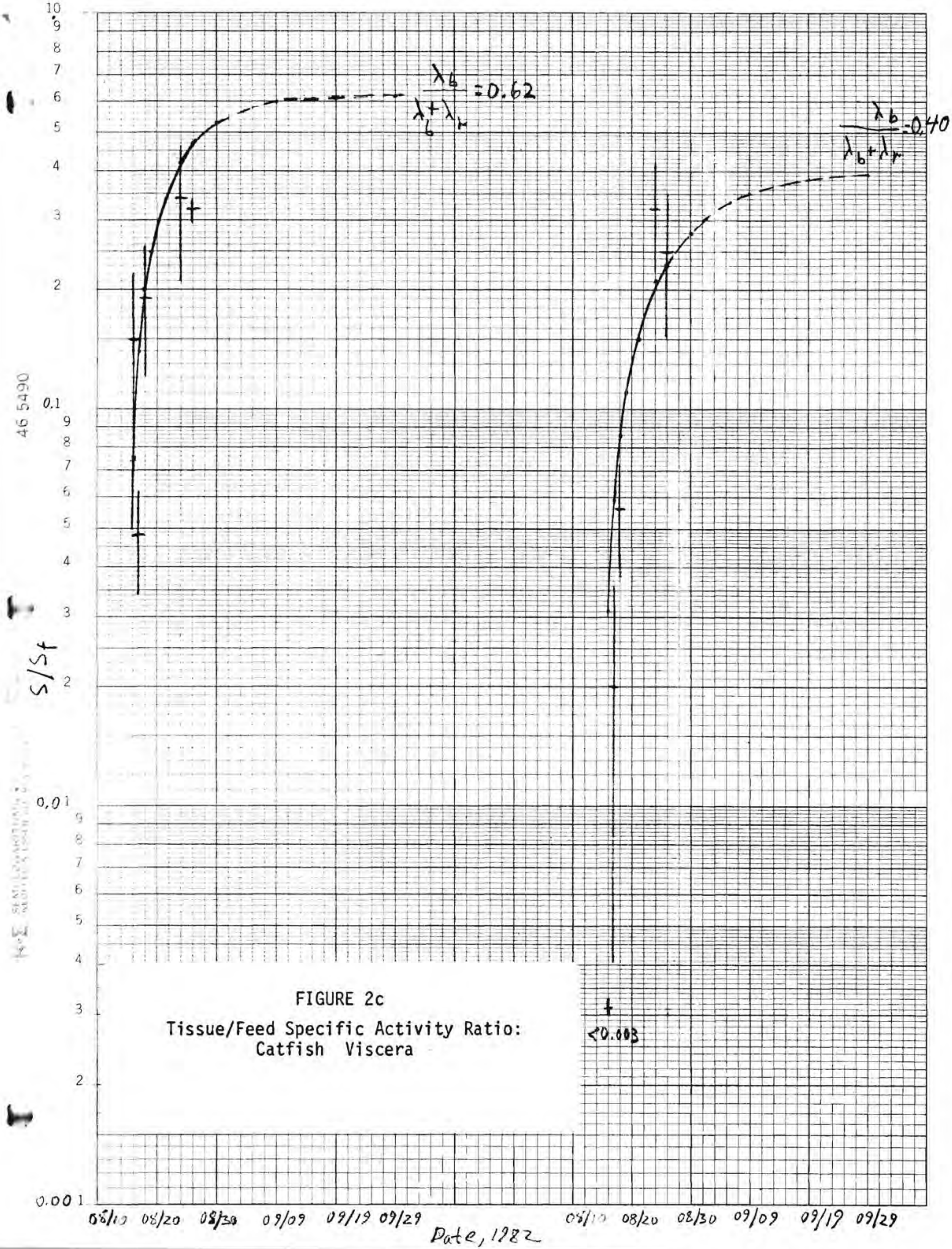

FIGURE 2c
Tissue/Feed Specific Activity Ratio:
Catfish Viscera

E-26-679

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Bioaccumulation of P-32 in Bluegill and Catfish

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Prepared for
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Bioaccumulation of P-32 in Bluegill and Catfish

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Abstract

Bluegill and catfish were fed P-32 at a constant feeding rate per body weight to determine the bioaccumulation factor (BF_r) for P-32 in muscle relative to water. The fish were maintained in flow-through tanks at two feeding levels. The bluegill accumulated P-32 for 51 days, followed by depuration for 28 days. The catfish study had to be terminated after 11 days. Fish were analyzed in triplicate for P-32 and phosphorus at intervals of 1 - 8 days. Additional aquaria experiments were performed to determine the effects of water temperature, feeding rate, and type of food (worms vs. pellets) on P-32 uptake, and to observe P-32 uptake from water by unfed fish (including fish with blocked esophagus).

A simple calculational model was used to determine the phosphorus turnover constant from the specific activity in tissue relative to food. This ratio at steady state approaches the BF_r/BF ratio (where BF is the phosphorus bioaccumulation factor) if P-32 transfers rapidly from water to food.

The bluegill showed a weight gain of 0.2 %/d, a phosphorus turnover constant in muscle of 0.43 %/d, and a BF_r/BF ratio of 0.081 at the higher feeding rate, and 0.05 %/d, 0.34 %/d, and 0.064 at the lower feeding rate. Hence, respective P-32 BF_r values are 6,000 and 4,000 at a phosphorus BF of 70,000. The BF_r values for catfish were approximately twice as high. The aquarium experiments suggest that the higher factors are due to a much higher phosphorus intake, higher water temperature, higher retention from pellets than from worms, and possible higher retention by catfish than bluegill under the same conditions.

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1. Introduction

The elemental bioaccumulation factor (BF) is widely used to compute public radiation doses due to a radionuclide discharged at nuclear facilities. The bioaccumulation factor for a specific radioisotope (BF_r) is obtained from stable element concentrations in a medium and in its precursor in the transfer pathway; from environmental monitoring data for the radionuclide in these two media; from field or laboratory tracer studies; or, if none of these sources of information is available, from data for homologous elements. Values for P-32 in edible tissue of freshwater fish are available from all of these direct data sources, but they range from below 100 to above 100,000. This laboratory tracer study was undertaken to recommend a reliable BF_r for P-32 in freshwater fish flesh.

A survey of the BF for all elements in edible aquatic organisms (Th72) recommended the value of 100,000 for freshwater fish, based on the ratio of the typical phosphorus concentration in muscle to that in water. A BF derived from stable element concentrations is recognized as being conservative because it represents the upper limit for the BF_r unless multiple pathways or physico-chemical forms complicate the situation (Th72). A more recent review of reported values for P-32 (Ka80) utilized earlier discussions of the bioaccumulation factor (Fo59, Po66, Pe71, Lo71, Th72, Va75) to identify the main reasons for the wide range:

(1) some higher BF_r values are based on P-32 concentrations in whole fish, for which the phosphorus concentration is more than twice as high as in muscle;
(2) the BF value is much higher than the BF_r value because the 14.3-day half life of P-32 prevents the fish from accumulating radioactive atoms to the same extent as stable ones;
(3) phosphorus concentrations in fish are homeostatically controlled, hence the BF is not constant but varies with the phosphorus concentration in water; and
(4) uptake of phosphorus in fish is mainly by food consumption rather than direct intake from water, hence the BF_r depends on the availability of P-32 in food and the food consumption rate by fish.

Considering only edible fish tissue, average BF_r values based on pond studies range from 800 to 12,000 (Wa57, Da58, Fo62, Il61) and those based on monitoring range from 600 to 1,600 (Ra74, Ka80).

Recalculation of the BF with more recently reported phosphorus concentrations in fish muscle and in larger U.S. streams suggested a generic value of 70,000 on the basis of a mean phosphorus concentration in fish muscle of 2 mg/g and in water of 0.03 mg/L (Ka80). Because concentrations between the first and ninety-ninth percentiles of reported values range by approximately a factor of two from the mean for tissue and by a factor of ten for water, the BF for a specific fish, location, and time can be considerably different than the generic value.

The BF_r for P-32 was calculated to be 3,000 on the basis of the BF of 70,000 and an estimated biological turnover constant of 0.002 per day for phosphorus in fish muscle (Ka80). This BF_r is now being used by the US NRC (Br82). The turnover constant was derived from such diverse sources, however, that experimental determinations of this constant and the associated ratio of BF_r to BF were recommended (Ka80).

In the main experiment described here, the pattern of P-32 accumulation and depuration was obtained to determine the biological turnover constant, and the pattern was observed at two-feeding levels to determine the influence of intake. Bluegill (Lepomis macrochirus) in a flow-through system, divided into a high-feed and a low-feed group, were subjected to P-32 accumulation for 51 days and to depuration for the following 28 days. Each group was fed a constant amount of worms per average body weight. During accumulation, P-32 was maintained at a nearly uniform specific activity in the worms. Sets of three fish were sacrificed, dissected, and analyzed for phosphorus and P-32 at intervals of 1 to 8 days. A parallel experiment with pellet-fed catfish (Ictalurus punctatus) had to be terminated after accumulation for 11 days.

Ancillary experiments were performed in aquaria for 9-day periods to examine the influence of species (bluegill vs. catfish), foods (worms vs. pellets), and water temperatures. A separate 4-day aquarium experiment with unfed fish -- some with blocked esophagus -- examined the extent of P-32 uptake directly from water. On some occasions, fish from the flow-through system were placed in aquaria for one day before sampling to measure excreted P-32 in water.

The data are reported in terms of specific activity (P-32 count/minute per mg phosphorus) for food, muscle, and other fish sections. The specific activity in tissue relative to that in food was used to determine the biological turnover constant and the ratio of BF_r to BF at steady state in terms of a simple 1-compartment model per tissue. The results are considered to be applicable to fish in the environment on the basis of observed growth rates, and the test fish were sufficiently large to represent fish caught for consumption.

2. Procedure

Laboratory Studies. the P-32 accumulation and depuration experiment was performed in two 2,000-Liter tanks, separated into halves by framed plastic netting. Tap water from the Atlanta municipal system flowed into each tank at 10 - 20 L/min after chlorine removal in two $0.2\text{-}m^3$ columns of activated charcoal and gravel (Bruner Manuf. Co.). Air was bubbled into each tank from 5 lines to maintain adequate oxygen concentration.

The oxygen content and temperature of the water were measured daily; chlorine, pH, nitrite and ammonia were measured daily at the beginning of the experiment and then occasionally. The oxygen was generally near saturation (8 - 10 mg/L) during the bluegill study and at lesser concentrations (4 - 8 mg/L) for the catfish study. The catfish were in the tank from August 15 to 26, 1982, at water temperatures of 24° - 26° C; the bluegill were in the tank from September 26 to December 15, 1982, while the water temperature gradually decreased from 22° to 16° C. Chlorine was below detection levels (less than 0.003 mg/L). The pH was near 6.0. The nitrite concentration was less than 0.3 mg/L and ammonia was between 0 and 2.5 mg/L.

On six occasions, excreted P-32 was measured. For this purpose, sets of three bluegill were transferred on the day before they were sacrificed from the flow-through system to an aquarium. The fish were moved, fed, and then maintained in 24 L water without further feeding. After the fish were removed for sampling, solids were collected from the aquarium bottom by siphoning and separated from water by filtering with a 75-micron filter; a sample of the filtered water was also retained for analysis.

These aquaria, and the ones used in the experiments described below, were 75-L glass containers, filled with dechlorinated water into which air was bubbled. Three fish were maintained per aquarium.

The effects of species, food and water temperature on bioaccumulation were observed on January 18 - 27 and February 8 - 17, 1983. Water was changed daily by replacing 55 L of a total 70-L volume. Attempts were made to maintain the water at temperatures of 15°, 20° or 25° C but some measured averages deviated from these values. Some bluegill were isolated with screens when more dominant fish were seen to prevent them from feeding.

Uptake of P-32 by six unfed bluegill was studied on December 6 - 10, and by six unfed catfish, on December 13 - 17, 1982. Each aquarium held three fish in 48 L water. To obtain the relatively high phosphorus concentration of 5 mg/L, equimolar in di- and mono-hydrogen phosphate, 9.66 mg NaH_2PO_4 and 11.43 mg Na_2HPO_4 were added per liter. This is the approximate distribution of phosphate at neutral pH. Tracer P-32 was added to the water with the phosp salts. The water temperature was 17 - 18° C. After two days, each set of fish was transferred to a second aquarium that contained a fresh batch of the same solution.

Two of the unfed bluegill and three catfish were prevented from swallowing by a water-filled 30-cc balloon inserted in the esophagus. Each fish was anesthetized before a modified Foley catheter (20 French with 30-cc balloon) was inserted. The balloon then was partially filled with water, the inflation channel to the balloon was blocked with a microstopper, and the channel was cut off at the mouth of the fish. After initial difficulties with two test fish, the fish lived through the 4-day period with the blocking device in place. Each group of three included fish with blocked and unblocked esophagus.

In the accumulation-depuration experiment, sets of three fish were sacrificed at weekly intervals, with additional samples on the first, second, and third days of accumulation and on the third day of depuration. The bluegill experiment began with 55 fish on the East (E) side and 51 fish on the West (W) side. The average weight was 122 g (range, 78 - 160 g) on the E side and 121 g (86 - 164 g) on the W side. The catfish experiment began with 69 fish in each half of the tank. The average weight was 170 g (68 - 284 g) on the E side and 167 g (67 - 267 g) on the W side.

In the aquarium experiments for examining the effects of feed and temperature on P-32 bioaccumulation, 24 bluegill and 24 catfish were used. The respective average initial weights were 115 g (73 - 167 g) and 166 g (122 - 271 g). The uptake of P-32 by unfed fish was studied with 6 bluegill and 6 catfish. Their respective average initial weights were 166 g (44 - 256 g) and 155 g (122 - 218 g).

Fish Maintenance. Approximately 200 bluegill were obtained from the Errol Brown Fish Farm, Fayetteville, GA, and Patrick's Fish Farm, Tifton, GA, on August 3 and 25, 1982. Approximately the same number of channel catfish were obtained from the Whitehall Laboratory of the University of Georgia on June 22 and from Mac's Fish Farm, Opelika, AL, on July 28. The fish had been spawned in the spring of 1981.

After initial problems in fish maintenance due to disease diagnosed as Ich (Ichthophthirius multiphilis - protozoan), fish were treated at monthly intervals by adding malachite green-formalin solution to the flow-through tank to minimize parasites and fungus. After fish were handled, they were treated in reduced water volume with furanace as an antibiotic. Both treatments were performed by stopping water flow, increasing aeration, and maintaining the fish in the appropriate solution for 1 hour or less (malachite-formalin) and 2 hours (furanace). The furanace concentration was 3 mg/L. The concentrations of zinc-free malachite and formalin were 0.03 and 0.05 mg/L, respectively. The tank walls were scrubbed during the latter treatment to expose all surfaces. The treatments were spaced to minimize shock to the fish.

The fish were kept in one flow-through tank until placed in the second tank or the aquaria for the experiments. Fish were acclimated for 14 days in the flow-through tanks and 7 days in the aquaria before beginning P-32 addition to food or water.

For identification by 3-digit number, catfish were branded on their left flanks with a copper marker dipped in liquid nitrogen, and bluegill had a nylon dart tag inserted behind the high point of the back arch, penetrating the dorsal fin rays. Both techniques were used for all fish, but brands tended to fade in bluegill while most catfish dislodged their tags.

The fish were weighed before the experiment, at approximately monthly intervals during accumulation-depuration, and after death. The live fish were anesthetized with tricaine methanesulfonate 2-2-2, weighed on a pan balance to the nearest 0.1 g, measured for length to the nearest 0.1 cm, identified by brand or tag, and quickly returned to water.

Feeding. In the accumulation-depuration experiment, bluegills were fed worms that had assimilated P-32 from labelled worm feed and catfish were fed pellets mixed with P-32. The low-feed and high-feed groups of a species were maintained in the separated halves of the tank. Efforts were made to keep the feed at a constant P-32 level per gram throughout the experiment, and the food intake at a uniform rate per weight of fish. Hence, (1) the aliquot of P-32 added to each daily portion was increased from day to day to adjust for radioactive decay, and (2) the total amount of food was adjusted from day to day to compensate for estimated fish growth and removal of fish for sampling. The high-feed portion had the same phosphorus concentration and P-32 specific activity as the low-feed portion, but provided higher daily intakes of phosphorus and P-32.

The initial plan was to expose each group of fish to daily doses of P-32 tracer for 60 days and then to observe depuration for another 60 days while feeding the same amount of nonradioactive food. Because of program changes requested by the US NRC, the study period for bluegill was shortened to accumulation for 51 days and depuration for 28 days. A plan to determine the P-32 balance in feed, fish, and water was also modified to collecting and analyzing water on a few occasions during the accumulation-depuration and aquarium studies. An accidental interruption in the flow of water during the night caused a fish kill that terminated the catfish accumulation study after 11 days, and the experiment could not be restarted because of the above-cited program changes.

Radioactive P-32 tracer was obtained in 2- or 4-mCi amounts on three occasions from New England Nuclear. The radionuclide was in the form of K_2HPO_4 in water, at a specific activity greater than 50 mCi/mmol phosphorus. This corresponded to a specific activity greater than $1x10^9$ count/min per mg phosphorus. Two stock solutions were prepared: the tracer diluted to 100 ml in deionized water and a further 1/10 dilution. More dilute solutions of these P-32 stock solutions were prepared to measure the P-32 activity, which in every case was consistent with the amount reported by the supplier.

Aliquots of the two stock solutions were combined with daily feed portions to provide a constant level of P-32 per gram feed for the entire period of a particular experiment. Daily feeding levels were selected to be below 0.4 µCi ($3x10^5$ count/min) per fish for the high-feed group, and one-half as much for the low-feed group. For the indicated flow rates with as many as 140 fish per tank, these daily amounts of P-32 permitted precise measurements of P-32 in tissue while keeping well below the maximum permissible concentration of 2×10^{-5} µCi/ml for P-32 in water discharged to the sewer.

The pellet feed was Purina trout chow. The amount prepared as a daily portion was calculated on the basis of the total initial weight of fish in the half tank, estimated weight gain and removal of fish for sampling, plus an additional 2 g for analyzing the P-32 and phosphorus content. Each portion of feed for the accumulation-depuration experiment was 2 g/d (dry weight) per 100-g catfish (wet weight) on the high-feed (East) side of the tank and one-half as much on the West side. The trout chow was ground to a powder and moistened with water until plastic in consistency. The P-32 tracer was added and mixed with the feed. The feed was then extruded with a meat grinder, cut into small (approx. 1 - 2 cm) pellets, dried, weighed again, and sealed in plastic bags until fed to the fish.

The weight of worms to be fed to the fish each day was calculated as indicated above for pellets, each portion constituting 3 g/d (moist weight) per 100 g bluegill on the high-feed (West) side and one-half as much on the East side. To introduce P-32 into worms, Carnation worm feed was moistened, P-32 tracer was added, and the worm feed was dried. For each weighed portion of red wiggler worms (0.2 - 0.5 g per worm, moist weight) in peat moss, 3 g worm feed with P-32 was added per 100 g worms (moist weight). On the following day, the worms were taken from the peat moss and placed on a dry surface, where worms separate themselves from the remaining pieces of peat moss by curling into balls to prevent desiccation. These worms were fed to the fish.

The bluegill were fed once daily (6 PM) and the catfish, twice daily (7 AM and 7 PM). The pellets or worms were scattered on the surface of the water a few at a time, to assure that all of the food would be consumed immediately by the fish. When the fish stopped feeding, any unconsumed food was weighed and this amount was subtracted from the nominal daily food portion. Small amounts of uneaten pellets were often observed on the tank bottom, but apparently all the worms were consumed.

Analysis. Bluegill were dissected into seven sections: muscle, tail fin, gill filaments, skin plus scales, viscera, skeleton (including dorsal and anal fins), and head (including gill arches, pectoral and pelvic fins, and girdles). After the first six sets of analyses in the accumulation-depuration experiment, the tail fin was included with the skeleton to reduce the analytical load. Catfish were dissected into eight sections: muscle, gills, skin, skeleton, head, viscera, fins, and fin spines. Internal organs were in the viscera and head portions. For the unfed fish, bluegill tail fins and catfish fin spines were combined with the skeleton, and catfish fins were combined with the head.

The sections were immediately weighed, dried at 110° C, and re-weighed. The sections were ashed, first in crucibles over an open flame and then at 550° C in a furnace for 2 - 4 days to obtain a white ash. The ash was weighed, dissolved in 6 N HCl, and diluted with distilled water to 100 ml for analysis. In a few instances, samples were divided into separate portions for replicate analyses or were diluted to larger volumes. Samples of pellets, worms and other solids were processed in the same way.

Aliquots of water from aquaria or the tap were usually taken in 4-L volumes, concentrated to 100 ml by evaporation, acidified with 10 ml conc. HNO_3 and 2 ml conc. H_2SO_4, and boiled until further concentrated to 10 ml. Acid addition and boiling were repeated as necessary to obtain a colorless solution. The solution was then diluted to 50 ml for analysis. If insoluble material was observed, the solution was filtered and saved for analysis. The filters were ashed and dissolved in HCl, and the solution was diluted to 50 ml for analysis.

The P-32 activity in all samples was measured in a liquid scintillation counter (Beckman LS 233) with an automatic sample changer. Each sample consisted of 20 ml solution that filled a conventional glass vial. The Cherenkov radiation emitted by energetic P-32 beta particles passing through water was detected. A channel setting of 0 - 2.6 (full scale: 10.0) was used to collect essentially all counts. The counting efficiency determined with a comparison P-32 source was 32 ± 4 percent under these conditions, but results were recorded in counts/minute because all data analysis was based on comparative measurements. The radiation background, measured for each set of analyses, ranged from 24 to 27 counts/min.

Duplicate aliquots were measured for each sample. Counting periods were 10 minutes for count rates above 200 count/min and 50 minutes for lesser count rates. The minimum detectable level under these conditions was approximately 2 counts/min. per 20 ml. In almost all instances, duplicate analyses agreed within twice the standard deviation of the count; if not, additional aliquots were counted. The count rate in the sample was calculated by adjusting for radioactive decay of P-32 since sample collection and for sample concentration.

The phosphorus concentration in all samples was measured with the vanadomolybdophosphoric acid colorimetric method (AP 80). Aliquots of the sample solutions ranging from 0.1 ml to 10 ml, depending on their phosphorus concentrations, were combined with the vanodomolybdate indicator in 50-ml volumetric flasks. If water samples larger than 1 ml were used, sufficient NaOH was added to neutralize the acid to pH 3. A Beckman DB-GT spectrophotometer was used to measure light transmission at 470 or 440 nm. Measured values were compared to a standard solution prepared from KH_2PO_4 salt (Fisher, Certified) which was dried at 40° C, weighed, dissolved and made to volume (0.2195 g/L) with 25 ml 7 $\underline{N}$ H_2SO_4. The phosphorus concentration in this solution is 50.0 mg/L.

Most phosphorus analyses were performed by direct measurement, but samples from each type of tissue were also analyzed by the standard addition technique. Samples for which results deviated considerably from the normal range for that tissue were also reanalyzed with standard addition. Replicate analyses showed a standard deviation of 2 percent by both techniques. The two techniques yielded results within 10 percent of each other and there was no consistent trend of one relative to the other.

The P-32 and phosphorus concentrations were calculated relative to wet weight of fish and feed sample or volume of water. The specific activity was obtained by dividing the P-32 concentration by the phosphorus concentration. Most observations were calculated in terms of a nondimensional relative value, the specific activity in fish tissue divided by the specific activity in the feed. These values were averaged for triplicate tissue analyses and for daily feed analyses. The reported plus/minus value is the standard deviation of the mean. For measurements in triplicate, standard deviations of the mean were estimated (NC78) to be 0.591 times the range, divided by the square root of 3.

<u>Field Study</u>. A field study at the Sequoyah Nuclear Plant near Chattanooga on the Tennessee R. (Chicamauga Lake) had been planned with TVA (the plant operator), US NRC, and US EPA staff. Aquatic samples were collected by plant personnel in a preliminary study and analyzed at the Eastern Environmental Radiation Facility, Montgomery, AL, of the Office of Radiation Programs, US EPA. The project then was discontinued by the plant operator because of the relatively low radiation dose for maximum exposed persons offsite attributed to P-32 releases (Ma83).

3. Results

All P-32 and phosphorus analytical data are compiled in the Appendices. Results for the accumulation-depuration experiment are in Appendix A. This appendix includes data for tissue (A.1), food (A.2), and water (A.3). Weight gain data for fish are in Appendix A.4 and comparisons of tissue weights with whole fish weight are in Appendix A.5. The corresponding information for experiments concerning the effects of water temperature and feed on P-32 accumulation are in Appendix B. Appendix C contains the data for unfed fish. Some additional information concerning the phosphorus levels in feed and water is in Appendix D.

Relatively large samples of catfish muscle and head that were divided into two or even three portions to fit into crucibles for ashing provide some replication of analytical results (see Appendix A.1-2). The average standard deviation of these 15 muscle and 4 head replicates was 0.09 mg/g (4 percent) for phosphorus in muscle and 4 mg/g (16 percent) for phosphorus in the head. The larger variability in the head reflects gross sectioning of this large body portion without effort to achieve homogeneity. Standard deviations of the P-32 count rate per gram were more variable. On the average, the standard deviation was 10 percent, five times the value due to counting error alone. The latter was computed from the count rate, length of counting period, radioactive decay factor, and amount of sample in the counted aliquot. Hence, sample preparation and sample nonuniformity appeared to be greater sources of variability than counting error.

Values of wet, dried, and ash weights relative to each other were used to check data reliability for the more than 800 tissue samples that were analyzed. In a few instances, clearly erroneous values were found. The results marked by footnotes in Appendices A.1, B.1, and C.1 did not change after reanalysis, suggesting problems due to sample preparation or identification. Values of P-32 specific activity and phosphorus concentration affected by these errors were not included in the calculations.

A change in dissecting instrument from fine scalpel to filet knife after the catfish skeleton samples listed in Apendix A.1-2 had been prepared resulted in lower phosphorus concentrations (compare Appendices B.1-2 and C.1). The change was made to reduce the time needed for dissecting these many samples, but appears to have left considerable soft tissue on skeletal samples. The summarized phosphorus concentration values are for initial higher values.

The concentrations of phosphorus and specific activity of P-32 were determined in each daily portion of worms for both the accumulation-depuration and the feed/temperature-effects experiments. The average phosphorus concentration was 1.2 mg/g wet weight, based on averages of 1.23 ± 0.03 (standard deviation of the mean) mg/g in

Appendix A.2-1 and 1.15 ± 0.03 mg/g in Appendix B.2-1. The specific activity in the worms was 6,020 ± 370 c/min.mg for the accumulation-depuration experiment, and 16,500 ± 1,300 c/min.mg for the feed and temperature study. The large standard deviation reflects variability in P-32 uptake by the worms. Values for the worms used in the accumulation-depuration experiment in the period Sept. 27 - Oct. 5 were not included in these averages because these samples were apparently contaminated with the peat moss in which the worms were kept.

The concentration of phosphorus in the pellets was 13.7 mg/g dry weight based on an average of 13.6 ± 0.4 mg/g for the period August 15 - 27 in Appendix A.2-2 and 13.7 ± 0.2 mg/g in Appendix B.2-2. The phosphorus concentration reported by the supplier (Appendix D.1) is 11 mg/g dried weight. The specific activity for the accumulation-depuration experiment was 7,000 ± 340 c/min.mg, and for the feed/temperature study, 21,900 ± 400 c/min.mg.

The average phosphorus concentration measured by Atlanta Water Bureau staff (Appendix D.2) in tap water was 0.4 mg/L; values ranged from 0.07 to 1.6 mg/L throughout the period. The phosphorus concentration in Chattahoochee River water at the water plant intake is relatively low (approx. 0.04 mg/L), but zinc metaphosphate is added at the water plant to a phosphorus level of 1 mg/L to reduce pipe corrosion. Concentrations of phosphorus in tap water measured for this study were 0.39 and 0.76 mg/L (Appendix A.3-1) and 0.26 mg/L (Appendix B.3-2). Concentrations of phosphorus in aquarium water in the course of studies ranged from 0.24 to 0.99 mg/L (Appendices A.3-1, B.3-1, and B.3-2). Some of this phosphorus was from unconsumed food or excretion by fish, as indicated by P-32 in water.

The initial phosphorus concentrations measured in water for determining uptake by unfed fish were 5.44 and 5.40 mg/L. These values are consistent with the average phosphorus content in tap water of 0.4 mg/L and the 5.0 mg/L added in the form of NaH_2PO_4 and Na_2HPO_4. The specific activities in the two sets of aquaria were 63,800 and 67,000 c/min.mg.

4. Calculations

The elemental bioaccumulation factor, BF, for phosphorus in edible fish tissue is defined as

$$BF = \frac{c_t}{c_w} \tag{1}$$

where c is the concentration of phosphorus in mg/g and the subscripts t and w refer to moist edible tissue and water, respectively. For consistency, muscle has been used to represent edible fish tissue, and total dissolved phosphorus data were used to obtain c_w (Ka80). It should be noted that tissue phosphorus is in various inorganic, lipid, protein, sugar and nucleotide forms that are not necessarily uniform throughout fish muscle; and that some reported phosphorus concentrations in water include suspended material, while others exclude dissolved phosphorus not readily converted to orthophosphates.

The radioisotope bioaccumulation factor, BF_r, for P-32 in edible fish tissue can be defined analogously as

$$BF_r = \frac{c_t^*}{c_w^*} \tag{2}$$

where the asterisks refer to radioactivity levels in consistent units, such as disintegrations/min per g. If the specific activity (P-32 relative to phosphorus), a, is expressed in disintegrations/min.mg,

$$\frac{BF_r}{BF} = \frac{a_t}{a_w} \tag{3}$$

In this report, specific activity values are in count/min.mg because the P-32 activity for all samples was measured identically -- i.e., the ratio of count/min to disintegration/min is identical.

The above relation holds true only if P-32 and the stable isotope, P-31, are in the same physico-chemical forms so that they behave identically. Because phosphorus exists in different forms, both inorganic and organic, and many of these do not readily interchange, it is possible that P-32 discharged into water may not be in the same forms as the nonradioactive phosphorus.

The values of BF reported and utilized for predicting radionuclide transfer are defined as equilibrium or steady-state constants. The corresponding value of BF_r would apply to a fish that has been exposed to a constant P-32 specific activity in water for a sufficiently long time that the specific activity in muscle has reached a constant value.

Intake data for fish suggest that under normal conditions the main source of phosphorus (> 99 percent) is food, not water (Ka80). Hence, the BF describes the indirect transfer of P-32 from water through biota at lower trophic levels to the fish under consideration. Transfer may be through a single organism, a food chain, or an entire food web. If bioaccumulation of phosphorus throughout the food web is very rapid relative to the P-32 radioactive decay constant of 0.0485 per day, then the ratio BF_r/BF is almost unity to the point of food intake by the fish. Rapid bioaccumulation has been found for plankton (Wh61), algae (Wh61) and bacteria (Ri56). Under this circumstance, the ratio BF_r/BF can be measured by comparing a_t with a_f, the specific activity in the food, so that

$$\frac{BF_r}{BF} = \frac{a_t}{a_f} \tag{4}$$

Any slow phosphorus uptake in the food web would result in BF_r/BF less than a_t/a_f.

Concentrations of phosphorus are generally of the same magnitude in the food consumed by the fish and in their muscle. Hence, the large BF is at the lower trophic levels of the food web, for example in algae.

The general case of bioaccumulation in a tissue represented as compartment can be described by

$$\frac{da_t}{dt} = - a_t \sum_{s=1}^{n} \frac{R_{st}}{Q_t} + \sum_{s=1}^{n} \frac{R_{st}}{Q_t} a_s + a_f \frac{R_{ft}}{Q_t} - a_t \frac{R_{ft}}{Q_t} - a_t \lambda_r \tag{5}$$

as defined in Appendix E. If R_{ft}/Q_t is written as the biological uptake or turnover constant for compartment t, λ_b, and R_{st}/Q_t is written as the turnover constant for transfer from any other compartment to compartment t, λ_s, then

$$\frac{da_t}{dt} = - a_t \sum_{s=1}^{n} \lambda_s + \sum_{s=1}^{n} \lambda_s a_s + a_f \lambda_b - a_t \lambda_b - a_t \lambda_r \tag{6}$$

If $\Sigma\lambda_s$ is combined as λ_u, the transfer constant into compartment t from all other compartments, the change of specific activity in compartment with time can be written as:

$$\frac{da_t}{dt} = - a_t (\lambda_b + \lambda_u + \lambda_r) + a_f \lambda_b + \sum_{s=1}^{n} \lambda_s a_s \tag{6a}$$

If $a_s = a_t$ or $\lambda_u = 0$, then the one-compartment equation can be solved:

$$\frac{a_t}{a_f} = \frac{\lambda_b}{\lambda_b + \lambda_r} (1 - e^{-(\lambda_b + \lambda_r)t_1}) e^{-(\lambda_b + \lambda_r)t_2} \tag{7}$$

where t_1 is the time during P-32 accumulation and t_2 is the time during depuration from the end of accumulation. The value of t_2 is zero during accumulation; during depuration, t_1 is the preceeding period of accumulation and a_f is the specific activity of the feed during accumulation.

If $a_s = 0$, a solution is:

$$\frac{a_t}{a_f} = \frac{\lambda_b}{\lambda_b + \lambda_u + \lambda_r} (1 - e^{-(\lambda_b + \lambda_u + \lambda_r)t_1}) e^{-(\lambda_b + \lambda_u + \lambda_r)t_2} \tag{8}$$

If a_s is not almost a_t or zero, then the equations can be solved numerically with measured values of a_s.

Further simplification in obtaining λ_b is possible by examining the specific activity ratio during selected periods of the study. In the very early period of accumulation,

$$\lambda_b t_1 = \frac{a_t}{a_f} \tag{7a}$$

During steady state accumulation,

$$\frac{\lambda_b}{\lambda_b + \lambda_r} = \frac{a_t}{a_f} \tag{7b}$$

During depuration,

$$\lambda_b + \lambda_r = \frac{1}{t_2} \ln \left(\frac{a_{t_1}}{a_{t_2}}\right) \tag{7c}$$

In these P-32 experiments, however, too few measurements applied to the region of equation (7a); the value obtained for λ_b with equation (7c) is not reliable when λ_b is much smaller than λ_r; and equation (7b) pertains only to the one-compartment system.

All a_t/a_f values from the bluegill experiment were used in a Marquardt nonlinear estimate to obtain λ_b in equation (7). Where it was apparent that equation (8) was better applicable, the sum $(\lambda_b + \lambda_u + \lambda_r)$ and the best value for a_t/a_f at $t_2 = 0$ were obtained by linear regression analysis of depuration data, and λ_b was obtained at $t_2 = 0$ from

$$\lambda_b = \frac{(\lambda_b + \lambda_u + \lambda_r)(\frac{a_t}{a_f})}{1 - e^{-(\lambda_b + \lambda_u + \lambda_r)t_1}} \tag{8a}$$

The value of λ_b for catfish was obtained as an average for 4 or 5 values of a_t/a_f measured during early accumulation by

$$\lambda_b = \frac{\lambda_r}{\frac{a_f}{a_t}\left(1 - e^{-(\lambda_b + \lambda_r)t_1}\right) - 1} \tag{7d}$$

For the unfed fish, λ_b was calculated with equation (7d) from the ratio a_t/a_f measured after four days of exposure. The value of $\lambda_b + \lambda_r$ in the exponent was obtained by trial and error, which is simple when λ_b is much smaller than λ_r.

The average concentration of phosphorus in the whole fish was calculated by averaging the phosphorus concentration, c_t, in the dissected portions and averaging the ratios of portion weight per summed weights, r_t, then multiplying these two averages, $\bar{c}_t\ \bar{r}_t$, for each portion and adding the results for the entire fish. The average turnover rate of phosphorus in each of the tissues from food, $\bar{R}_{ft}$, is

$$\bar{R}_{ft} = \lambda_b\ \bar{c}_t\ \bar{r}_t \tag{9}$$

Values of $\bar{R}_{ft}$, in units of mg/day per 100-g fish, were summed for the whole fish to obtain the phosphorus turnover rate for the entire fish. This value was divided by the average phosphorus concentration to compute the average biological turnover constant for the whole fish. The phosphorus turnover rate was also compared to the phosphorus feeding rate to determine the fraction of ingested phosphorus that was utilized, and to the phosphorus concentration in water for unfed fish for determining the daily amount of water utilized by the fish.

Endogenous excretion of P-32 was calculated for comparison with the results of 1-day collections in Appendices A.3-1 and A.3-2 on the basis of viscera turnover rates and P-32 concentrations. The average P-32 content in the viscera of the three bluegill maintained in aquaria during the day before analysis (see Appendix A.1-1) on five occasions during depuration was multiplied by the viscera turnover constant (minus a small fraction for fish growth). Excretion of unabsorbed or rapidly turning over P-32 was also calculated for the one set of fish segregated in aquaria during accumulation on the basis of the P-32 feeding rate per fish on 11/08 and the estimated fraction of rapidly excreted phosphorus from this food.

5. Discussion

5.1 Feeding rate and growth

The uptake of P-32 by freshwater fish was studied primarily by incorporating P-32 tracer in food rather than water because an estimated phosphorus balance for fish indicated that the main intake pathway was through food (Ka80). Reported dissolved phosphorus concentrations in the larger U.S. streams averaged 0.03 mg/L and 99 percent of the concentrations were less than 0.4 mg/L. At the reported food-phosphorus intake of several mg/day per 100-g fish and water intake of several ml/day per 100-g fish, only a minute fraction could be contributed by water.

Relatively few observations of food intake rates over extended periods were available to guide fish feeding for this experiment, although selection of appropriate feeding rates is crucial for assuring that observed phosphorus turnover rates are pertinent for fish in the environment. Food consumption varied considerably in the few reported studies, as would be expected for different species, fish size, foods, and water temperatures. In five intake studies for freshwater fish, average food intake ranged from 2 to 6 g/day per 100-g fish and increased with water temperature in the range 5 to 30° C (Ka80). The corresponding average phosphorus intakes were from 1 to 30 mg/day per 100-g fish. In four balance studies where fish fed <u>ad lib.</u>, (St74, Ma71, Ki75, Ko79) three of which utilized very small bluegill sunfish, the typical phosphorus intake rate was 4 mg/day per 100-g fish (0.3 percent per day phosphorus intake) in the 17 - 25° C temperature range and much lower intakes at 1 - 12° C. Growth rates for these fish averaged 0.3 percent per day.

Brown (Br57) calculated the maintenance food requirement of 1.5 g/day per 100-g fish for small (50 g) brook trout, and the food requirement of 4.5 g for 1 percent growth. If the food is meat with a phosphorus content of 1.5 mg/g wet weight, then the phosphorus requirements are 2.2 mg/d per 100-g fish for maintenance and an additional 0.7 mg/day for each 0.1 percent/d growth.

In view of the above information, the rate at which bluegill were fed worms with a phosphorus content of 1.2 mg/g wet weight was planned at levels of 1.5 and 3.0 g/d per 100-g fish. In practice, the average feed consumption ranged from 0 to 2.0 and from 0 to 4.3 g/d per 100-g fish at the two respective levels during P-32 accumulation (see App. A.2-1). The average daily food intakes were 1.5 and 2.6 g/d per 100-g fish, corresponding to phosphorus intake rates of 1.8 and 3.1 mg/d per 100-g fish.

The feeding rates for catfish were planned at pellet dry weights of 1.0 and 2.0 g/d per 100-g fish. These pellets had the high phosphorus content of 13.7 mg/g. Actual consumption rates averaged 0.8 (range 0.2 - 1.5) and 1.1 (0.4 - 2.0) g/d per 100-g fish (see App. A.2-2), corresponding to phosphorus intake rates of 11 and 15 mg/d per 100-g fish.

Average growth constants were used as indicators of the applicability of these feeding regimes to normal environmental conditions, although various other factors can also affect phosphorus turnover in tissue. The average measured growth constants for bluegill were 0.05 and 0.19 percent/d at the lower and higher feeding rates, based on the data in Appendix A.4. For the catfish, growth constants were 0.2 and 0.4 percent/d at the much higher phosphorus intakes than for bluegill. The data for catfish are much more uncertain because of the relatively brief period of observation. Measurements of bluegill, black crappie, and bass in an East Tennessee lake (Kr56) showed growth rates of 0.10, 0.06, and 0.35 percent/d (Ka80), respectively, in the 60 - 600 g weight range.

Unfed fish in water at the uncommonly high phosphorus concentration of 5.4 mg/L had an average weight loss of 0.7 percent/d in a 4-day period (Appendix C.3). Fish maintained in the same aquaria but fed worms or pellets also tended to lose weight during their 9-day study period (Appendix B.4).

5.2 Phosphorus concentrations in fish

The mean phosphorus concentrations in bluegill were 2.4 and 15.4 mg/g in muscle and whole fish, respectively, as shown in Table 1a; in catfish, they were 2.2 and 8.8 mg/g (Table 1b). Geometric means were obtained because phosphorus concentrations in fish had been described better by a logarithmic distribution than a linear one (Ka80). As indicated in the footnotes to Tables 1a and 1b, the phosphorus concentration values in whole fish are subject to a nonrandom error due to losses during dissection that averaged 6 percent of the fish weight for bluegill and 7 percent for catfish.

Compared to whole-body concentrations between 2.2 and 11.4 mg/g reported earlier (Ka80) for various species, the average for catfish measured here is among the higher values and the bluegill average is the highest observed. Most of the phosphorus in these two species is in bone material and in bluegill scales. Muscle contains only a small fraction of the body phosphorus -- 4 percent in bluegill and 11 percent in catfish. The amount of phosphorus measured in the viscera may include some residual food.

5.3 Accumulation and depuration of P-32

The ratios of the specific activity in bluegill muscle to the food worms, a_t/a_f, near the end of the accumulation period were 0.049 and 0.072 for fish fed 1.5 and 2.6 g/d per 100-g fish, respectively, as shown in Tables 2a and 2b. According to equation (4), this value is also the ratio of the bioaccumulation factor for P-32 relative to phosphorus when P-32 moves rapidly through the food web. The ratios

Table 1a

Geometric Mean Tissue Weight Fraction and Phosphorus Concentration in Bluegill Tissue

Tissue	Tissue weight fraction		P concentration in tissue, mg/g		P concentration rel. to whole fish, mg/g
muscle	0.260	(1.20)	2.41	(1.11)	0.63
skeleton & tail	0.219	(1.09)	18.0	(1.20)	3.94
(skeleton	0.211	(1.13)	17.2	(1.20)	3.63)
(tail	0.0095	(1.18)	33.2	(1.14)	0.32)
head	0.331	(1.10)	19.2	(1.18)	6.36
scales	0.108	(1.20)	39.9	(1.23)	4.31
gills	0.0056	(1.27)	2.27	(1.30)	0.013
viscera	0.065	(1.24)	2.19	(1.21)	0.14
total	0.989				15.39

Notes:
1. Data are from the 92 fish in the experiment using the flow-through system.
2. Values in parentheses are geometric standard deviations.
3. The weight fraction refers to the sum of the dissected tissues; the summed weight averaged 94.5 percent (range 86.1 - 99.5 percent) of the weight before dissection (see Appendix A.5-1).
4. Skeleton and tails were separated initially but combined in later samples.

Table 1b

Geometric Mean Tissue Weight Fraction and
Phosphorus Concentration in Catfish Tissue

Tissue	Tissue weight fraction		P concentration in tissue, mg/g		P concentration rel. to whole fish, mg/g
muscle	0.452	(1.07)	2.24	(1.12)	1.01
skeleton	0.088	(1.16)	14.2	(1.16)	1.25
fin	0.027	(1.12)	13.9	(1.15)	0.38
fin spine	0.0032	(1.20)	91.0	(1.19)	0.29
head	0.257	(1.08)	22.0	(1.14)	5.65
skin	0.056	(1.17)	1.39	(1.19)	0.078
gills	0.0081	(1.29)	2.15	(1.36)	0.017
viscera	0.100	(1.29)	1.68	(1.26)	0.17
total	0.991				8.85

Notes: 1. Data are from 30 fish collected 08/16 - 08/26 (see Appendix A.1-2)
2. Values in parentheses are geometric standard deviations.
3. The weight fraction refers to the sum of the dissected tissues; the summed weight averaged 93.1 percent (range, 90.4 - 95.2 percent) of the total weight before dissection (see Appendix A.5-2).

Table 2a
Average Specific Activity in Tissue Relative to Feed for Bluegill during Accumulation and Depuration (Low Feed)

Date, 1982	Interval, days(1)	Muscle	Skeleton	Tail	Head	Scales/ Skin	Gills	Viscera
09/28	1	0.65 ± 0.24 (2, 3)	0.27 ± 0.15	0.5 ± 0.3	0.18± 0.12	0.18± 0.10	2.5± 1.8	7.8± 0.8
09/29	2	5.8 ± 1.9	1.5 ± 0.4	1.9 ± 0.4	1.3 ± 0.2	1.1 ± 0.3	29 ± 13	110 ± 40
09/30	3	7.3 ± 3.8	1.5 ± 0.6	2.4 ± 1.0	1.6 ± 0.8	1.1 ± 0.4	38 ± 19	140 ± 80
10/06	9	29 ± 4	3.7 ± 0.5	6.0 ± 1.8	3.5 ± 0.6	3.3 ± 1.3	100 ± 17	270 ± 60
10/12	15	51 ± 13	6.6 ± 2.5	7.0 ± 2.2	4.8 ± 1.4	3.5 ± 1.1	120 ± 35	170 ± 20
10/19	22	50 ± 4	8.0 ± 3.2	9.0 ± 1.8	6.6 ± 2.2	5.1 ± 1.9	120 ± 19	120 ± 30
10/26	29	42 ± 17	6.6 ± 2.7	----	5.5 ± 1.9	5.5 ± 2.0	86 ± 28	170 ± 60
11/03	37	49 ± 8	10.3 ± 2.3	----	8.6 ± 0.8	6.1 ± 0.7	120 ± 14	200 ± 20
11/09	43	42 ± 6	7.6 ± 2.8	----	5.0 ± 1.4	5.1 ± 1.6	120 ± 12	170 ± 30
11/17	51(0)	49 ± 10	9.3 ± 3.0	----	9.8 ± 4.3	6.6 ± 2.3	140 ± 31	190 ± 60
11/20	(3)	65 ± 26	8.1 ± 1.9	----	7.1 ± 0.8	5.8 ± 1.0	101 ± 25	116 ± 11
11/24	(7)	50 ± 6	6.0 ± 0.9	----	5.3 ± 0.6	4.3 ± 0.5	80 ± 6	82 ± 4
11/30	(13)	30 ± 4	3.7 ± 0.7	----	3.0 ± 1.0	2.4 ± 0.5	48 ± 9	39 ± 4
12/07	(20)	16 ± 4	3.2 ± 1.5	----	2.8 ± 1.2	1.7 ± 0.7	28 ± 5	22 ± 4
12/15	(28)	15 ± 1	1.7 ± 0.3	----	1.3 ± 0.3	1.2 ± 0.1	20 ± 3	10.6± 1.2

Notes: (1) Days in parentheses refer to depuration period. (2) Divide all values of c/min.g tissue ÷ c/min.g feed by 1,000. (3) value is estimated standard deviation of mean for 3 fish tissue values [0.59 x range/$(3)^{0.5}$] combined with standard deviation of mean for 41 bluegill feed values (370 c/min.g) or for 5 catfish feed values (300 c/min.g). (4) Specific activity ratios in parentheses were not utilized because of large weight losses (>0.006 per day) by fish.

Table 2b
Average Specific Activity in Tissue Relative to Feed for Bluegill
during Accumulation and Depuration (High Feed)

Date, 1982	Interval, days(1)	Muscle	Skeleton	Tail	Head	Scales/ Skin	Gills	Viscera
09/28	1	5.6 ± 1.1	1.2 ± 0.3	1.5 ± 0.4	1.2 ± 0.2	0.6 ± 0.2	34 ± 14	210 ± 70
09/29	2	13.3 ± 1.0	3.1 ± 0.2	2.6 ± 0.3	2.6 ± 0.2	1.9 ± 0.3	60 ± 5	190 ± 20
09/30	3	11.0 ± 0.8	2.1 ± 0.3	2.3 ± 0.3	2.4 ± 0.3	1.5 ± 0.1	56 ± 10	350 ± 30
10/06	9	32 ± 4	8.5 ± 0.8	10.6 ± 0.9	9.8 ± 1.6	7.6 ± 1.5	120 ± 15	340 ± 40
10/12	15	47 ± 17	8.6 ± 3.0	10.3 ± 2.5	8.3 ± 3.4	6.5 ± 2.0	103 ± 16	260 ± 20
10/19	22	69 ± 12	14 ± 2	11.8 ± 3.2	11.1 ± 1.6	7.8 ± 1.5	190 ± 25	200 ± 10
10/26	29	76 ± 16	10.0 ± 0.8	----	6.8 ± 0.5	5.3 ± 0.7	140 ± 25	210 ± 20
11/03	37	50 ± 13	8.3 ± 3.0	----	6.1 ± 1.9	5.0 ± 1.6	120 ± 28	200 ± 20
11/09	43	70 ± 17	8.0 ± 2.4	----	6.0 ± 1.5	5.6 ± 1.4	130 ± 13	180 ± 40
11/17	51(0)	72 ± 13	13 ± 3	----	10.6 ± 1.3	7.0 ± 1.5	170 ± 22	210 ± 20
11/20	(3)	54 ± 9	11 ± 2	----	6.8 ± 0.7	6.5 ± 0.7	130 ± 11	120 ± 20
11/24	(7)	56 ± 11	7.1 ± 1.5	----	5.8 ± 1.0	5.0 ± 0.7	100 ± 10	94 ± 7
11/30	(13)	48 ± 8	11 ± 3	----	8.6 ± 3.2	5.8 ± 1.7	60 ± 6	53 ± 4
12/07	(20)	25 ± 2	5.6 ± 1.7	----	4.3 ± 1.2	3.3 ± 1.1	33 ± 6	29 ± 2
12/15	(28)	18 ± 4	3.7 ± 0.4	----	3.0 ± 0.5	2.4 ± 0.3	17 ± 2	14 ± 1

Table 2c

Average Specific Activity in Tissue Relative to Feed for Catfish during Accumulution (High Feed)

Date, 1982	Interval, days	Muscle	Skeleton	Fins	Fin Spines	Head	Skin	Gills	Viscera
08/16	1	16 ± 10	3.7 ± 1.7	5.4 ± 2.7	2.5 ± 0.8	3.0 ± 1.3	28 ± 14	23 ± 5	150 ± 80
08/17	2	9 ± 5	1.9 ± 0.8	3.8 ± 1.2	1.0 ± 0.3	1.7 ± 0.7	14 ± 5	19 ± 8	48 ± 14
08/18	3	21 ± 7	6.1 ± 1.2	8.6 ± 0.8	3.1 ± 0.6	5.2 ± 1.3	36 ± 9	52 ± 5	190 ± 70
08/24	9	83 ± 38	25 ± 10	19. ± 10.	17. ± 11.	19. ± 8	108 ± 38	170 ± 81	340 ± 130
08/26	11	77 ± 18	24 ± 6	27 ± 7	9.9 ± 2.3	17 ± 4	130 ± 10	160 ± 27	320 ± 20

Table 2d

Average Specific Activity in Tissue Relative to Feed for Catfish during Accumulation (Low Feed)

Date, 1982	Interval, days	Muscle	Skeleton	Fins	Fin Spines	Head	Skin	Gills	Viscera
08/16	1	(0.25± 0.06) (4)	(0.05± 0.03)	(<0.09)	(<0.2)	(0.06± 0.03)	(<3)	(1.4± 0.8)	(<0.3)
08/17	2	3.7 ± 2.3	1.3 ± 1.1	1.6± 0.5	0.4 ±0.2	0.6 ± 0.3	7.5 ± 4.	10 ± 6	20 ± 16
08/18	3	10.3 ± 3.1	2.8 ± 0.8	4.1± 0.9	1.4 ±0.4	2.7 ± 0.8	15. ± 4	27 ± 5	56 ± 18
08/24	9	57 ±33	12.0 ± 6.0	16 ± 8	8.5 ±6.2	8.0 ± 4.0	97 ± 49	120 ±57	320 ± 100
08/26	11	77 ±36	15.0 ± 7.0	17 ± 8	5.9 ±2.1	13. ± 6	130 ± 63	120 ± 44	250 ± 100

for the entire experiment are reasonably consistent with equation (7) for a single-compartment system (see Fig. 1a). These curves indicate steady state ratios of 0.064 and 0.081 respectively for the low-feed and high-feed groups. The biological turnover constants for phosphorus uptake by muscle of 0.0033 d^{-1} and 0.0043 d^{-1}, respectively, given in Table 3a, correspond to these curves.

The average specific activity ratios in other bluegill tissues at the various sampling dates are also given in Tables 2a and 2b and in Figs. 1b - 1g. The average biological turnover constants and steady-state bioaccumulation factors for P-32 relative to phosphorus for these tissues are summarized in Table 3a on the basis of the same one-compartment model as for muscle. The following patterns appear:

- The fish fed larger portions had higher turnover constants and bioaccumlation factor ratios in all tissus. The ratio of high-feed to low-feed λ_b averaged 1.30; values for all 6 tissues measured during the entire study period were within 1 standard error value of this average.

- These values were similar in the skeleton, head, tail, and scales, all of them being approximately an order of magnitude below the values for muscle; gills had higher values than muscle, and viscera values were highest.

- Some very high specific activity ratios during the first two weeks of accumulation, particularly in the viscera, do not fit the curve for the single-compartment model.

- The single compartment model provides a reasonable fit for the tissues that turn over more slowly, but depuration measurements show this model to be inappropriate for gills and viscera.

The summed turnover constants and specific activity ratios at the beginning of depuration, determined by regression analysis of the depuration data (see Table 4), were utilized in equation (8a) to calculate the biological turnover constants shown in the last two lines of Table 4. In most cases, the turnover constant for a tissue is similar to the one in Table 3a and even the largest differences are within 50 percent. Utilization of the third turnover constant, to account for dilution of phosphorus in the tissue by phosphorus from other tissues that have almost no P-32, results in the better fit for gills and viscera given by the dotted lines in Figs. 1f and 1g. The complexity introduced by the additional constant was not considered useful for data analysis of the tissues that turn over more slowly.

The three total turnover constants with values from 0.008 to 0.012 d^{-1} below the minimum of 0.0485 d^{-1} for only radioactive decay in Table 4 may indicate the extent of uncertainty for values derived only from depuration. If values of λ_b plus λ_u (the third turnover constant) are

Table 3a

Computed Phosphorus Turnover Constants and Bioaccumulation Factor Ratios for Worm-fed Bluegill

Section	Turnover constant, day^{-1}		BF_r/BF, steady state	
	Low feed	High feed	Low feed	High feed
Muscle	0.0033 ± 0.0002	0.0043 ± 0.0002	0.064	0.081
Skeleton	0.00050 ± 0.00002	0.00068 ± 0.00006	0.0102	0.014
Tail	(0.00075 ± 0.00007)	(0.0012 ± 0.0001)	(0.015)	(0.024)
Head	0.00042 ± 0.00002	0.00053 ± 0.00006	0.0086	0.0108
Scales/skin	0.00034 ± 0.00002	0.00041 ± 0.00004	0.0070	0.0084
Gills	0.0081 ± 0.0006	0.0102 ± 0.0009	0.14	0.17
Viscera	0.013 ± 0.002	0.018 ± 0.005	0.21	0.27

Notes: 1. Turnover constants and standard errors were obtained through Marquardt nonlinear estimation, except that values for Tail were estimated from only 6 accumulation measurements.

2. BF_r/BF at steady state is a_t/a_f and $\lambda_b/(\lambda_b + \lambda_r)$

Table 3b

Estimated Phosphorus Turnover Constants and Bioaccumulation Factor Ratios for Pellet-fed Catfish

Section	Turnover constant, day^{-1}		BF_r/BF, steady state	
	Low feed	High feed	Low feed	High feed
Muscle	0.0058 ± 0.0018	0.0100 ± 0.0023	0.107	0.17
Skeleton	0.0013 ± 0.0003	0.0027 ± 0.0005	0.026	0.053
Fins	0.0016 ± 0.0003	0.0033 ± 0.0006	0.032	0.064
Fin spines	0.0006 ± 0.0002	0.0016 ± 0.0004	0.013	0.032
Head	0.0010 ± 0.0002	0.0021 ± 0.0004	0.020	0.042
Skin	0.010 ± 0.003	0.016 ± 0.004	0.17	0.25
Gills	0.012 ± 0.003	0.020 ± 0.003	0.20	0.29
Viscera	0.030 ± 0.009	0.075 ± 0.024	0.38	0.61

Notes: 1. Turnover constants were obtained by averaging values measured during initial 11 days of accumulation.
2. BF_r/BF at steady state is a_t/a_f and $\lambda_b/(\lambda_b + \lambda_r)$

Table 4

Phosphorus Biological Turnover Constants Based on Depuration for Worm-fed Bluegill

	Feeding Level	Muscle	Skeleton	Head	Scales	Gills	Viscera
Mean total turnover constant, day^{-1}(1)	Low	0.055	0.059	0.067	0.064	0.071	0.101
	High	0.049	0.040	0.037	0.037	0.082	0.092
Correlation coefficient	Low	0.94	0.990	0.98	0.990	0.993	0.996
	High	0.97	0.89	0.86	0.95	0.999	0.996
Specific activity ratio, beginning of depuration (1)	Low	0.062	0.0092	0.0089	0.0065	0.129	0.167
	High	0.072	0.0141	0.0093	0.0073	0.171	0.182
Non-radioactive turnover constant, day^{-1}(2)	Low	0.006	0.011	0.018	0.016	0.022	0.052
	High	0.001	-0.008	-0.012	-0.012	0.034	0.044
Compartment biological turnover constant, day^{-1}(3)	Low	0.0036	0.00057	0.00062	0.00043	0.0094	0.017
	High	0.0038	0.00065	0.00041	0.00032	0.014	0.017

(1) Values were calculated by linear regression analysis of average specific activity ratios for 6 sets of samples collected during depuration.
(2) Non-radioactive turnover constant is mean total turnover constant minus 0.0485 day^{-1}.
(3) Values were calculated with equation (8a).
(4) Feeding level: "Low" is 1.5 g/d per 100-g fish, "High" is 2.6 g/d per 100-g fish.

uncertain at least to that extent, the biological turnover constants in Table 4 are less reliable than in Table 3a, except for gills and viscera. The negative values could also be due to some continued uptake of P-32 from other tissues after the end of accumulation, a possibility ignored by the assumptions for equation (8).

The initially higher specific activity ratios and the subsequent decreases during accumulation, particularly in the viscera, are not consistent with uniform conditions. The most reasonable explanation, in view of some P-32 totals in the high-feed bluegill during the first three days (see Appendix A.2-1) that exceed the intake due to worms alone, suggests contamination of the feed during the first few days by P-32 in peat. Factors that could contribute to this trend are the gradually decreasing water temperature, the gradually increasing fish weight, and fluctuations in daily P-32 intakes.

The average specific activity ratios for catfish muscle relative to pellet feed in Tables 2c and 2d were fitted with the curves shown in Fig. 2a to yield turnover constants of 0.0058 d^{-1} and 0.010 d^{-1} for fish fed 0.8 and 1.1 g/d per 100-g fish, respectively (see Table 3b). The corresponding ratios of the bioaccumulation factors for P-32 relative to phosphorus are 0.11 and 0.17. These values are considerably less certain than for bluegill because they were obtained from only four or five values early in the accumulation period.

Average specific activity ratios for other dissected portions of catfish are given in Tables 2c and 2d and in Figs. 2b to 2h. Curves of equation (7) are shown in these figures, and the turnover constants resulting in the best fits of curve to data are listed in Table 3b, together with associated ratios of the bioaccumulation factors for P-32 relative to phosphorus. The catfish turnover constants and bioaccumulation factor ratios show the same patterns as for bluegill:

- fish fed larger food portions had higher turnover constants and bioaccumulation factor ratios in all tissues;

- lowest values were in skeleton, head, fins, and fin spines; turnover constants for muscle were three to ten times as high, values for skin and gills were even higher, and values for the viscera were highest.

The phosphorus turnover rates in Table 5, calculated from the turnover constants in Tables 3a and 3b and the tissue phosphorus concentrations in Tables 1a and 1b, indicate uptake rates from 1 to 4 mg/d per 100-g fish for the two species at the two feeding levels. At the lower phosphorus feeding rate for bluegill, the daily phosphorus uptake was approximately one-half of the amount fed. Uptake was a higher fraction of the intake at the lower feed rate, as would be expected. In catfish, the uptake was a much lower fraction of the feed intake

Table 5

Phosphorus Turnover Rates for Tissues and Turnover Constants for Whole Bluegill and Catfish

Tissue	P turnover rate, g/d.100-g fish			
	Bluegill		Catfish	
	Low feed	High feed	Low feed	High feed
muscle	0.21	0.27	0.58	1.01
skeleton	0.18	0.24	0.16	0.034
tail	0.024	0.034	----	----
fin	---	---	----	----
fin spine	---	---	0.017	0.046
head	0.27	0.34	0.56	1.19
scales	0.15	0.18	----	----
skin	---	---	0.078	0.12
gills	0.010	0.013	0.021	0.035
viscera	0.18	0.25	0.51	1.28
total turnover rate	1.02	1.32	1.99	4.15
fraction of feed rate	0.57	0.44	0.18	0.28
mean turnover constant, d^{-1}	0.00066	0.00086	0.0022	0.0047

Notes: 1. The phosphorus turnover rate is the product of the tissue turnover constant (Table 3) and the tissue phosphorus concentration (Table 1)

2. The fraction of feed rate is the total turnover rate divided by feeding rates of 1.8, 3.0, 11, and 15 mg/d.100-g fish, respectively.

3. The mean turnover constant for the whole fish is the total phosphorus turnover rate divided by the total phosphorus concentration (Table 1).

and, surprisingly, the fish with larger daily portions took up a somewhat larger fraction of the feed.

The mean turnover constants for phosphorus in the whole fish, also listed in Table 5, were similar to the growth constants in catfish. In bluegill, the phosphorus turnover constant was similar to the growth constant in the low-feed group but only one-half as large in the high-feed group. The turnover constants in whole bluegill were similar to the values in bone material due to the large fraction of body phosphorus in that tissue. In catfish, where bone material does not constitute such a large fraction of body mass, the whole-body phosphorus turnover constants are intermediate to those in bone and other tissues.

The phosphorus excretion measured in water for a day (Appendix A.3-1 and A.3-2) is endogenous excretion from the listed tissues plus excretion of that fraction of the daily phosphorus intake that passes through the fish so rapidly that it is not measured in viscera 24 hours after intake. The endogenous excretion constant in a single-compartment system is the difference between what has here been called the turnover constant (actually, the uptake constant) and the growth constant. The much larger turnover constant in viscera than in muscle suggests that a larger fraction of visceral phosphorus is excreted. At least part of this turnover phosphorus originates in other tissues (as represented by λ_u).

The daily P-32 excretion rate is predicted in Table 6 for bluegill on the basis of the rapidly excreted P-32 intake (in only the first of the six tests) plus the relatively small contributions of endogenous P-32. The rapidly excreted P-32 was taken to be one-half of the feed, as suggested by the averages in Table 5.

In all subsequent tests, the feed contained no P-32. Endogenous excretion was estimated from the viscera specific activity, amount of phosphorus (see Appendix A.1-1), and turnover constant. A value of $0.04\ d^{-1}$ was used for the latter, based on the non-radioactive turnover constants from Table 4 minus a small fraction for phosphorus utilized for growth. These values are compared with P-32 measurements on the indicated dates -- one during accumulation and the other five during depuration.

Predicted P-32 excretion rates ranged widely about the values measured in water and suspended material. The differences are believed to be due to large day-to-day fluctuations about the mean values of turnover and excretion rates. Excretion rates may also have been affectd by stress on the fish from handling them and transferring them to the aquarium.

5.4 Factors that affect the phosphorus turnover constant

Table 6

Excreted P-32 in Aquarium Water from Bluegills
during Accumulation and Depuration

Date, 1982	Average viscera P-32/P, c/min.mg	Average P per fish viscera, mg	Average P-32 excretion rate per fish, c/min.d. Calculated: slow	Calculated: rapid	Measured: dissolved	Measured: suspended
11/09	E: 1,008	14.4	580	7,200	950	960
	W: 1,095	16.7	730	14,400	7,300	730
11/20	E: 703	20.1	570	0	2,800	240
	W: 736	20.5	600	0	8,200	<140
11/24	E: 496	19.3	380	0	~300	<120
	W: 563	21.0	470	0	1,200	<120
11/30	E: 236	18.6	180	0	250	< 80
	W: 320	28.2	360	0	3,900	< 80
12/07	E: 132	17.3	91	0	<140	< 70
	W: 172	17.3	120	0	370	< 70
12/15	E: 64	30.2	65	0	<120	< 40
	W: 83	23.0	76	0	<120	< 40

Notes: 1. Rapid turnover is 7,200 c/min.g x g feed/fish x rapid fraction; feed was 2 g/fish in E and 4 g/fish in W, and rapid fraction is approximately 0.5.
2. The measured daily values were obtained for a 25-hr period on 11/09, a 24-hr period on 11/30, and 20-hr periods on all other days; the values have not been adjusted for deviations from 24 hrs.

The experiments in the flow-through system yielded higher phosphorus turnover constants for higher feeding rates both in worm-fed bluegill and pellet-fed catfish. The higher turnover constants in catfish than in bluegill are for much higher daily phosphorus intakes. Factors such as the higher water temperatures for the catfish and dissimilar foods, with phosphorus in different forms, can contribute to the difference. Inherent characteristics in phosphorus body content and utilization or better acclimation to the experimental conditions could also cause a higher turnover constant in catfish. Finally, any comparison of phosphorus turnover constants between bluegill and catfish needs to recognize the larger uncertainty due to the early termination of the catfish experiment.

Data in Tables 7a-h from the parallel experiments performed in aquaria for 9 days are considered less reliable than from the flow-through tanks because of poor acclimation by fish as indicated by low pellet consumption, weight loss and large variability in tissue P-32 levels. Furthermore, inadvertent changes in water temperature for some aquaria prevented direct comparisons at the same temperature. The results are consistent among the various tissues, however, and suggest some trends in phosphorus turnover constants.

<u>Water temperature</u>. The accumulation of P-32 in the bluegill and catfish at 11° C was far below that at temperatures between 19 and 27° C. Direct comparison of catfish fed pellets at 0.9 g/d per 100-g fish consistently shows slightly higher P-32 accumulation at 24° than at 20° C. Temperature changes prevented comparisons between 20° and 25° C for bluegill, but increased turnover constants as a function of temperature in the range of 10 - 25° C have been reported for small bluegill (Ki75, Ko79). Increased food intake at higher temperatures over this range is commonly observed (Da30, Pe39, Ni74), and would be expected to cause increased phosphorus turnover.

<u>Aquaria vs. flow-through system</u>. Catfish fed pellets at 0.9 g/d per 100-g fish and 24° C in aquaria accumulated less P-32 in muscle, skin, gills, and viscera but the same in bone material (skeleton, head, fins, and fin spines), than catfish in the flow-through system after 9 days. The latter were at approximately the same water temperature and feeding rate.

Direct comparisons are not available for bluegill, but these fish at slightly lower temperatures in the flow-through system consistently accumulated more P-32 than in the aquaria at worm-feeding rates of both 1.5 and 2.6 g/d per 100-g fish. Although some of these accumulation values in the flow-through system at 9 days are unusually high, as indicated in Figures 1a - g, the consistently lower values in the aquaria suggest poorer acclimation by the fish.

Table 7a

Specific Activity in Tissue Relative to Food in Fish
Maintained 9 Days in Aquaria: Muscle

Feed, per 100 g fish per day			Average temperature, °C		
Worms, g moist	Pellets, g dry	P, mg	11	19 - 20	23 - 27
0.9	---	1.0	0.003 ± 0.002	----	----
1.4 - 1.6	---	1.7 - 1.9	----	(0.029)(3)	0.013 ± 0.010(1) 0.012 ± 0.002 0.027 ± 0.009(2)
2.4 - 2.6	---	2.9 - 3.1	----	(0.032)	0.020 ± 0.003
2.9 - 3.0	---	3.5 - 3.6	----	----	0.018 ± 0.013 0.024 ± 0.013 0.036 ± 0.010
---	0.3 - 0.4	4.7 - 5.6	0.002 ± 0.002	0.030 ± 0.016	0.064 ± 0.025
---	0.5 - 0.6	6.6 - 8.5	----	0.063 ± 0.009 <0.001(1)	----
---	0.8 - 0.9	10.8 - 12.1	----	0.042 ± 0.042 0.024 ± 0.006	0.036 ± 0.009 (0.057)
---	1.1	15.1	----	----	(0.083)

(1) Average fish weight loss exceeded 0.006 day^{-1}.
(2) Values for catfish are underlined
(3) Values in parentheses are measurements in flow-through tanks.
(4) Means of triplicate values are given; ± values are $0.591\ R/3^{0.5}$, where R is the range of triplicate values

Table 7b

Specific Activity in Tissue Relative to Food in Fish
Maintained 9 Days in Aquaria: Skeleton

Feed, per 100 g fish per day			Average temperature, °C		
Worms, g moist	Pellets, g dry	P, mg	11	19 - 20	23 - 27
0.9	---	1.0	0.0013 ± 0.0007	----	----
1.4 - 1.6	---	1.7 - 1.9	----	(0.004)	0.003 ± 0.002(1) 0.003 ± 0.001 0.012 ± 0.004
2.4 - 2.6	---	2.9 - 3.1	----	(0.008)	0.005 ± 0.001
2.9 - 3.0	---	3.5 - 3.6	----	----	0.006 ± 0.003 0.005 ± 0.004 0.018 ± 0.007
---	0.3 - 0.6	4.7 - 5.6	0.0008 ± 0.0008	0.011 ± 0.007	0.030 ± 0.012
---	0.5 - 0.6	6.6 - 8.5	----	0.026 ± 0.001 <0.0001(1)	----
---	0.8 - 0.9	10.8 - 12.1	----	0.010 ± 0.010 0.011 ± 0.002	0.014 ± 0.004 (0.012)
---	1.1	15.1	----	----	(0.025)

Table 7c

Specific Activity in Tissue Relative to Food in Fish
Maintained 9 Days in Aquaria: Head

Feed, per 100 g fish per day			Average temperature, °C		
Worms, g moist	Pellets, g dry	P, mg	11	19 - 20	23 - 27
0.9	---	1.0	0.0015 ± 0.0008	----	----
1.4 - 1.6	---	1.7 - 1.9	----	(0.004)	0.003 ± 0.002(1) 0.004 ± 0.001 0.008 ± 0.002
2.4 - 2.6	---	2.9 - 3.1	----	(0.010)	0.005 ± 0.001
2.9 - 3.0	---	3.5 - 3.6	----	----	0.005 ± 0.003 0.005 ± 0.004 0.012 ± 0.004
---	0.3 - 0.5	4.7 - 5.6	0.005 ± 0.0005	0.011 ± 0.006	0.020 ± 0.008
---	0.5 - 0.6	6.6 - 8.5	----	0.016 ± 0.001 <0.0001(1)	----
---	0.8 - 1.0	10.8 - 12.1	----	0.010 ± 0.010 0.007 ± 0.002	0.009 ± 0.003 (0.008)
---	1.1	15.1	----	----	(0.19)

Table 7d

Specific Activity in Tissue Relative to Food in Fish
Maintained 9 Days in Aquaria: Fins

Feed, per 100 g fish per day			Average temperature, °C		
Worms, g moist	Pellets, g dry	P, mg	11	20	24 - 27
1.4	---	1.7	----	----	0.012 ± 0.004
3.0	---	3.6	----	----	0.016 ± 0.005
---	0.3 - 0.4	4.7 - 5.6	0.0016 ± 0.0016	----	0.026 ± 0.014
---	0.5 - 0.6	6.6 - 8.1	----	0.022 ± 0.001 <0.0001(1)	----
---	0.8 - 0.9	11.0 - 12.1	----	0.009 ± 0.002	0.013 ± 0.005 (0.016)
---	1.1	15.1	----	----	(0.019)

Table 7e

Specific Activity in Tissue Relative to Food in Fish
Maintained 9 Days in Aquaria: Fin Spines

Feed, per 100 g fish per day			Average temperature, °C		
Worms, g moist	Pellets, g dry	P, mg	11	20	24 - 27
1.4	---	1.7	----	----	0.004 ± 0.001
3.0	---	3.6	----	----	0.006 ± 0.001
---	0.3 - 0.4	4.7 - 5.6	0.0003 ± 0.0003	----	0.011 ± 0.006
---	0.5 - 0.6	6.6 - 8.5	----	0.006 ± 0.001 <0.0001(1)	----
---	0.8 - 0.9	11.0 - 12.1	----	0.003 ± 0.001	0.004 ± 0.002 (0.008)
---	2.0	15.1	----	----	(0.017)

Table 7f

Specific Activity in Tissue Relative to Food in Fish
Maintained 9 Days in Aquaria: Skin and Scales

Feed, per 100 g fish per day			Average temperature, °C		
Worms, g moist	Pellets, g dry	P, mg	11	19 - 20	23 - 27
0.9	---	1.0	0.0010 ± 0.0005	----	----
1.4 - 1.6	---	1.7 - 1.9	----	(0.003)	0.002 ± 0.001(1) 0.003 ± 0.001 0.031 ± 0.009
2.4 - 2.6	---	2.9 - 3.1	----	(0.008)	0.004 ± 0.001
2.9 - 3.0	---	3.5 - 3.6	----	----	0.005 ± 0.003 0.005 ± 0.004 0.044 ± 0.012
---	0.3 - 0.5	4.7 - 5.6	0.005 ± 0.005	0.008 ± 0.005	0.071 ± 0.025
---	0.5 - 0.6	6.6 - 8.5	----	0.065 ± 0.009 <0.0005(1)	----
---	0.8 - 1.0	10.8 - 12.1	----	0.008 ± 0.008 0.027 ± 0.007	0.040 ± 0.010 (0.097)
---	1.1	15.1	----	----	(0.11)

Table 7g

Specific Activity in Tissue Relative to Food in Fish
Maintained 9 Days in Aquaria: Gills

Feed, per 100 g fish per day			Average temperature, °C		
Worms, g moist	Pellets, g dry	P, mg	11	19 - 20	23 - 27
0.9	---	1.0	0.023 ± 0.011	----	----
1.4 - 1.6	---	1.7 - 1.9	----	(0.10)	0.030 ± 0.020(1) 0.043 ± 0.011 0.040 ± 0.009
2.4 - 2.6	---	2.9 - 3.1	----	(0.12)	0.063 ± 0.020
2.9 - 3.0	---	3.5 - 3.6	----	----	0.046 ± 0.019 0.063 ± 0.046 0.056 ± 0.014
---	0.3 - 0.5	4.7 - 5.6	0.006 ± 0.006	0.11 ± 0.05	0.14 ± 0.03
---	0.5 - 0.6	6.6 - 8.5	----	0.081 ± 0.008 <0.0005(1)	----
---	0.8 - 1.0	10.8 - 12.1	----	0.069 ± 0.067 0.036 ± 0.010	0.063 ± 0.011 (0.12)
---	1.1	15.1	----	----	(0.084)

Table 7h

Specific Activity in Tissue Relative to Food in Fish
Maintained 9 Days in Aquaria: Viscera

Feed, per 100 g fish per day			Average temperature, °C		
Worms, g moist	Pellets, g dry	P, mg	11	19 - 20	23 - 27
0.9	---	1.0	0.07 ± 0.02	----	----
1.4 - 1.6	---	1.7 - 1.9	----	(0.27)	0.12 ± 0.05(1) 0.11 ± 0.04 0.09 ± 0.03
2.4 - 2.6	---	2.9 - 3.1	----	(0.34)	0.12 ± 0.02
2.9 - 3.0	---	3.5 - 3.6	----	----	0.15 ± 0.05 0.10 ± 0.07 0.15 ± 0.05
---	0.3 - 0.4	4.7 - 5.6	0.05 ± 0.05	0.26 ± 0.13	0.19 ± 0.03
---	0.5 - 0.6	6.6 - 8.5	----	0.19 ± 0.04 <0.001(1)	----
---	0.8 - 0.9	10.8 - 12.1	----	0.16 ± 0.13 0.11 ± 0.05	0.13 ± 0.01 (0.32)
---	1.1	15.1	----	----	(0.34)

Food phosphorus intake. The increase in P-32 accumulation with food intake by worm-fed bluegill in aquaria at three feeding rates is consistent with the increase observed in the flow-through system. Worm-fed catfish in aquaria show the same trend. For pellet-fed catfish, however, P-32 accumulation decreased with higher food intake in aquaria, both at 20° and at 24° C. Combined with the data from the flow-through system, this trend would indicate decreasing accumulation between phosphorus intake rates of 5 and 11 mg/d per 100-g fish, followed by an increase between 11 and 15 mg/d per 100-g fish. Such a minimum does not seem reasonable and may be an artifact due to poor acclimation to the aquaria.

Catfish vs. Bluegill. Catfish fed worms in aquaria at approximately 25° C at two feeding rates had approximately twice the P-32 accumulation in muscle and bone as bluegill, while accumulation in gills and viscera was approximately equal. Comparison of pellet-fed fish was not conclusive because of the wide range of replicate bluegill results. Data for all tissues except scales plus skin are consistent. The latter can not be compared because that tissue is mostly scales in bluegill and skin in catfish, with widely different phosphorus concentrations and turnover constants.

Worm vs. pellet feed. Only approximate comparisons are possible because worms and pellets were not fed at identical levels of daily phosphorus intake. The closest comparison is for catfish in aquarium water at 24° C fed pellets at 0.32 g/d per 100-g fish (a phosphorus intake rate of 4.7 mg/d per 100-g fish) and at 26° C fed worms at 3.0 g/d per 100-g fish (3.6 mg/d per 100 g). Accumulation from pellets averaged 1.8 times the accumulation from worms, considerably higher than would be expected from the trend based on the P-32 accumulation in worm-fed catfish. On the other hand, catfish in aquaria fed even more pellets -- 0.80 g/d per 100-g fish -- at 25° C accumulated approximately the same P-32 levels as these worm-fed catfish. The comparison of bluegill in aquarium water at 19° C fed pellets at 0.41 g/d per 100-g fish (5.6 mg/d per 100 g) with bluegill at 24 - 25° C fed worms at 2.9 g/d per 100-g fish (3.5 mg/d per 100 g) also suggests greater accumulation than would be expected from the increase in phosphorus intake rate but at a lower water temperature.

Analyses of the water in all aquaria on the eighth day of the study show that, with a few exceptions, approximately one-half of the P-32 fed on that day was in the water (see Appendices B.3-1 and B.3-2). This fraction is consistent with the ratio of the average daily turnover (uptake) rates to feeding rates for bluegill in Table 5. The very low uptake values for fish in water at 11° C (aquaria No. 1, App. B.3-1 and B.3-2) are supported by the observation that more than 90 percent of the P-32 in the feed was in the water. The worm-fed catfish (in aquaria No.7 and 8), on the other hand, retained more than 80 percent of the feed, consistent with the much higher accumulation by these fish than by bluegill (see Table 7). The P-32 in water is attributed to endogenous material rather than phosphorus dissolved or leached from feed because the feed was promptly consumed, little feed remained uneaten, and there appears to be little difference in the P-32 fraction from worms and pellets.

In summary, the aquarium experiments indicate higher phosphorus turnover constants for catfish than for bluegill, phosphorus uptakes increasing with daily intake rates at least for lower values, and possibly higher uptakes with pellets compared to worms. The higher turnover constants in catfish may be due to their lesser body phosphorus contents. The turnover constant is expected to increase less rapidly than phosphorus intake at high feeding rates, although this was not the case for the catfish in the flow-through system. Any difference between pellet and worm feed may be due to different forms of P-32. It was added to pellets as phosphate ions, whereas the worms undoubtedly metabolized much of the P-32 to form organic compounds.

5.5 Phosphorus uptake from water

The specific activities in tissue relative to water summarized in Table 8 confirm the conclusion reached earlier (Ka80) that fish take up very little dissolved phosphorus directly from water, compared to their uptake from food. The relative specific activity in the control fish, even at the extremely high dissolved phosphorus concentration (5.6 mg/L) in aquarium water, was lower by factors between 40 and 250 than on the 4th day of feeding the smaller daily portions.

The turnover constants in these control fish at the indicated low uptake rates were only $2 \times 10^{-5}\ d^{-1}$ for bluegill muscle and $3 \times 10^{-5}\ d^{-1}$ for catfish muscle (see Table 9). The constants in muscle, skeleton, and head sections were similar for bluegill and catfish exposed to the same phosphorus concentrations in water.

The daily phosphorus uptake rates for a 100-g fish of 27.8 µg in bluegill and 13.0 µg in catfish (Table 9) correspond to respective water intake rates of 5.1 and 2.4 ml/d. Drinking rates between 0 and 18 ml/d have been reported for freshwater fish (Ka80).

The remarkable observation for both bluegill and catfish with blocked esophagus is that the specific activity in tissues relative to water was approximately double the value in the control fish, as summarized in Table 8. Hence, the turnover constants and daily uptake rates in muscle as well as in the whole fish were twice as great as in control fish (see Table 9). Although small amounts of P-32 measured in these fish may be due to accumulation on surfaces externally and in the mouth, the higher specific activities throughout the fish when the esophagus is blocked suggest an additional mechanism, such as stimulation of ionic uptake at some surfaces, e.g. the gills and mouth.

Table 8

Specific Activity in Tissue Relative to Water for Unfed Fish
Maintained 4 Days in Aquaria (1)

Species	Treatment	Muscle	Skeleton	Head	Skin/Scales	Gills	Viscera
Bluegill	Blocked	0.18 ± 0.01	0.10 ± 0.02	0.06 ± 0.01	0.06 ± 0.01	2.0 ± 0.1	8.8 ± 0.6
	Control	0.08 ± 0.03	0.05 ± 0.03	0.03 ± 0.01	0.03 ± 0.01	0.6 ± 0.1	4.7 ± 2.5
Catfish	Blocked	0.18 ± 0.02	0.12 ± 0.01	0.08 ± 0.02	0.24 ± 0.05	0.64 ± 0.02	1.2 ± 0.6
	Control	0.10 ± 0.01	0.05 ± 0.01	0.03 ± 0.01	0.08 ± 0.02	< 0.3	1.1 ± 0.3
Bluegill	- worms, low (2)	11	2	2	1.5	50	200
	- worms, high(2)	17	4	4	3.0	70	350
Catfish	- pellets, low (2)	20	5	4	20	40	110
	- pellets, high(2)	40	10	6	40	60	200

(1) Divide all values by 1,000
(2) Specific activity in tissue relative to food was interpolated for 4th day from data for fish in flow-through tank
(3) Specific activity in water was 57,000 c/min.mg for bluegill and 60,200 c/min.mg for catfish.
(4) Catfish fin spines and bluegill tails are with skeleton, and catfish fins with the head.

Table 9

Phosphorus Uptake Rate and Turnover Constant for Unfed Fish

Tissue	$a_t/a_f \times 10^3$		P, mg/g wet	Tissue, g/100-g fish		P uptake rate $\times 10^3$, mg/d.100-g fish		P turnover constant $\times 10^3$, d^{-1}	
	B	U		B	U	B	U	B	U
Bluegill									
Muscle	0.18	0.08	2.5	26.1	25.1	3.2	1.4	0.050	0.022
Skeleton	0.10	0.05	17.6	21.2	23.4	10.3	5.7	0.028	0.014
Head	0.06	0.03	18.9	29.2	33.2	9.1	5.2	0.016	0.008
Scales	0.06	0.03	41.5	11.1	11.3	7.6	3.9	0.016	0.008
Gills	2.0	0.6	3.0	0.50	0.41	0.8	0.2	0.55	0.16
Viscera	8.8	4.7	2.2	4.8	4.05	21.3	11.4	2.4	1.3
Whole fish			15.4	92.9	97.4	52.3	27.8	0.037	0.019
Catfish									
Muscle	0.18	0.10	2.6	31.3	28.3	4.0	2.0	0.050	0.028
Skeleton	0.12	0.05	8.6	15.0	16.8	4.3	2.0	0.033	0.014
Head	0.08	0.03	14.2	27.1	28.3	8.5	3.3	0.022	0.008
Skin	0.24	0.08	2.1	7.3	9.6	1.0	0.4	0.066	0.022
Gills	0.64	<0.3	3.2	0.62	0.58	0.3	<0.2	0.18	<0.08
Viscera	1.2	1.1	2.0	8.8	8.9	5.8	5.3	0.33	0.30
Whole fish			6.4	90.1	92.5	23.9	13.0	0.041	0.022

Note: B: fish with blocked esophagus; U: control fish

Direct uptake of P-32 at very low rates has been observed earlier, both for unfed fish (He45) and for fish with blocked esophagus (To58). Uptake of HPO_4^{-2} ions at gill and oral cavity membranes has been postulated without further discussion (La77).

5.6 P-32 discharged at a nuclear power station

The brief environmental survey at the Sequoyah Nuclear Power Plant, operated by TVA at the Tennessee River (Chicamauga Lake) near Chattanooga, TN, showed the presence of P-32 in liquid effluent, and in periphyton, zooplankton, bluegill sunfish and catfish (see Table 10). Similar concentrations in liquid effluent have been found at other nuclear power stations (Bl76, Ka74).

The aquatic samples were collected by TVA staff from the river and from a pond into which the liquid effluent was discharged prior to further dilution in the river. The concentration of P-32 in pond water was estimated by TVA staff to be between 0.1 and 0.5 pCi/L during discharge of liquid waste at the concentrations indicated in Table 10.

The observed P-32 levels in catfish flesh and whole sunfish suggest a concentration factor of one to several thousand relative to pond water (Ma73). Because waste discharges are periodic, these values do not reflect steady-state conditions. On the other hand, exposure to P-32 is not usually as brief as indicated by discharge periods because P-32 tends to accumulate in sediment and then gradually reenter the water column (Ha52, Ha58, Po65). The higher P-32 concentrations in some pond periphyton samples support the high P-32 bioaccumulation factor predicated on rapid phosphorus turnover relative to radioactive decay.

Most samples from the river were below detection levels for P-32, but several positive measurements were obtained in fish and zooplankton. These may be briefly elevated levels during the period of waste release, or could be due to transfer of suspended material with high P-32 levels from pond to lake. Without further studies, the P-32 levels observed here indicate the potential for detectable P-32 concentrations downstream from nuclear power stations, but do not provide BF_r values.

Table 10

P-32 Concentrations in the Aquatic Environment at the Sequoyah Nuclear Plant (1)

Description	Location	Date Collected	P-32, pCi/kg(2)
periphyton	river	09/08/81	< 5,000
periphyton	pond	09/08/81	20,000 ± 60%
zooplankton	pond	09/08/81	< 15,000
zooplankton	river discharge	09/08/81	< 15,000
zooplankton	river (intake background)	09/08/81	< 15,000
catfish flesh	river	09/10/81	< 30
catfish bone & viscera	river	09/10/81	< 120
sunfish flesh	river	09/10/81	< 80
sunfish bone & viscera	river	09/10/81	< 400
catfish flesh	pond	09/10/81	280 ± 12%
catfish bone, etc.	pond	09/10/81	750 ± 17%
H_2O unfiltered	pond inflow	09/11/81	< 1
H_2O unfiltered	pond inflow	09/11/81	< 1
H_2O filtered	pond - gate	09/11/81	< 1
H_2O filtered	pond - gate	09/11/81	< 1
H_2O unfiltered	pond inflow	09/15/81	< 1
H_2O unfiltered	pond - gate	09/15/81	< 1
H_2O unfiltered	pond inflow	09/15/81	< 1
H_2O filtered	pond - gate	09/15/81	< 1
catfish flesh	pond	09/15/81	125 ± 12%
catfish bone, etc.	pond	09/15/81	280 ± 30%
sunfish - whole	pond	09/15/81	740 ± 15%
catfish flesh	river	09/15/81	< 30
catfish bone, etc.	river	09/15/81	< 90
sunfish flesh	river	09/15/81	130 ± 20%
sunfish bone, etc.	river	09/15/81	330 ± 50%
zooplankton	pond	09/17/81	20,000 ± 90%
zooplankton	river (487)	09/17/81	20,000 ± 90%
zooplankton	river (483.4)	09/17/81	< 12,000
periphyton	river	09/17/81	< 2,000
periphyton	pond	09/17/81	15,000 ± 70%
H_2O discharge	waste tank	09/15/81	1,500 ± 10%
H_2O composite	waste tank	09/09-15/81	1,950 ± 5%
H_2O composite	waste tank	09/16-22/81	680 ± 10%
H_2O discharge	waste tank	09/22/81	820 ± 10%

(1) All values were reported by Robert J. Lyon, Eastern Environmental Radiation Facility, Office of Radiation Programs, USEPA.
(2) Percent indicates standard deviation of counting.

6. Conclusions

A phosphorus turnover constant of 0.0043 d^{-1}, corresponding to a bioaccumulation factor ratio for P-32 relative to phosphorus of 0.081, was obtained for bluegill muscle. These bluegill were fed worms at a rate of 2.6 g/d. per 100-g body weight in a flow-through tank maintained at 16 - 22° C. The phosphorus content of the worms was 1.2 mg/g. The initial weight of the bluegill averaged 121 g (range 86 - 164 g), and they gained an average 0.19 percent/d in the 79-day study period. Combined with the generic phosphorus bioaccumulation factor of 70,000 recommended earlier, the ratio yields a P-32 bioaccumulation factor of 6,000. This value is the bioaccumulation in muscle relative to water under these conditions if P-32 accumulates rapidly in the food chain. The bioaccumulation factor ratio was approximately 20 percent lower for bluegill fed fewer worms, at a rate believed to be just above maintenance level.

In parallel studies with catfish (average weight, 168 g) fed pellets that contained five times as much phosphorus, in water at 24 - 26° C, bioaccumulation factor ratios were twice as high. Ancillary studies suggest that bioaccumulation factor ratios increase with water temperature between 11 to 27° C, and with phosphorus intake from 1 to 5 mg/d per 100-g fish. The bioaccumulation factor ratio also appears to be higher for catfish, which have a much lower phosphorus body content than bluegill, and higher with pellet feed with ionic P-32 content than with worms that contain metabolized P-32.

Measurements of P-32 and phosphorus concentrations in other fish tissue show phosphorus turnover constants approximately 5-fold lower than muscle in bluegill skeleton, head, and scales and catfish skeleton, head, and fins. Turnover constants are several times higher than muscle in the viscera and gills of both species and in catfish skin. Turnover constants for whole fish were approximately one-fifth the muscle value in bluegill and two-fifths the muscle value in catfish.

Uptake and depuration of P-32 in bluegill muscle, skeleton, head, and scales can be described with a simple 1-compartment model that relates the specific activity in tissue to that in feed by means of the phosphorus turnover constant and the P-32 radioactive decay constant. The specific activity data observed for viscera and gills require additional turnover constants to account for the movement of phosphorus among tissues.

This study demonstrates that the bioaccumulation factor for P-32 is substantially lower than that for phosphorus because phosphorus turnover in fish muscle is slow compared to the radioactive decay of P-32. If the whole fish is considered rather than muscle, the bioaccumulation factor is slightly higher because the higher muscle turnover constant is outweighed by the lower phosphorus concentration in muscle than in the whole fish. In bluegill, average phosphorus concentrations relative to wet weight in muscle and whole fish were 2.4 and 15.4 mg/g, respectively; in catfish, they were 2.2 and 8.8 mg/g.

That the major intake pathway for phosphorus is food rather than water is established by phosphorus uptakes between 1 and 4 mg/d per 100-g fish. Typical phosphorus concentrations in water are in the range of only 0.005 - 0.5 mg/L. An experiment with unfed fish in water with extremely high (5.6 mg/L) phosphorus concentration, approximately equi-molar in the forms of mono- and di-hydrogen phosphate, yielded P-32 uptakes associated with a water intake of 2 - 5 ml/d. At this very small phosphorus uptake, however, the unexpected result was that fish with a blocked esophagus accumulated twice as much P-32 in their tissues as control fish. Hence, some uptake of phosphate may be due to ion transfer at surfaces, stimulated by the stress of blockage.

The P-32 bioaccumulation factor presented above for bluegill that were fed 2.6 percent/d and gained 0.19 percent/d is believed to apply on an annual average basis in the environment, but wide variations would be expected due to different phosphorus intakes at certain time periods and locations. Species differences that could affect phosphorus turnover constants need also to be considered. Where P-32 discharges by nuclear facilities could lead to significant radiation doses to persons eating fish, detailed monitoring is desirable to consider possibly higher P-32 transfers as a function of specific fish species and metabolism, pathway, form of phosphorus, or ambient conditions.

The flow-through system was found to be effective in maintaining fish healthy and growing for a sufficiently long period and is recommended for use in similar uptake studies. Specific activity measurements during both accumulation and depuration provided unambiguous values of turnover constants and bioaccumulation factors. Similar determinations in fish are suggested for radionuclides with uncertain BF_r due to widely different observed values.

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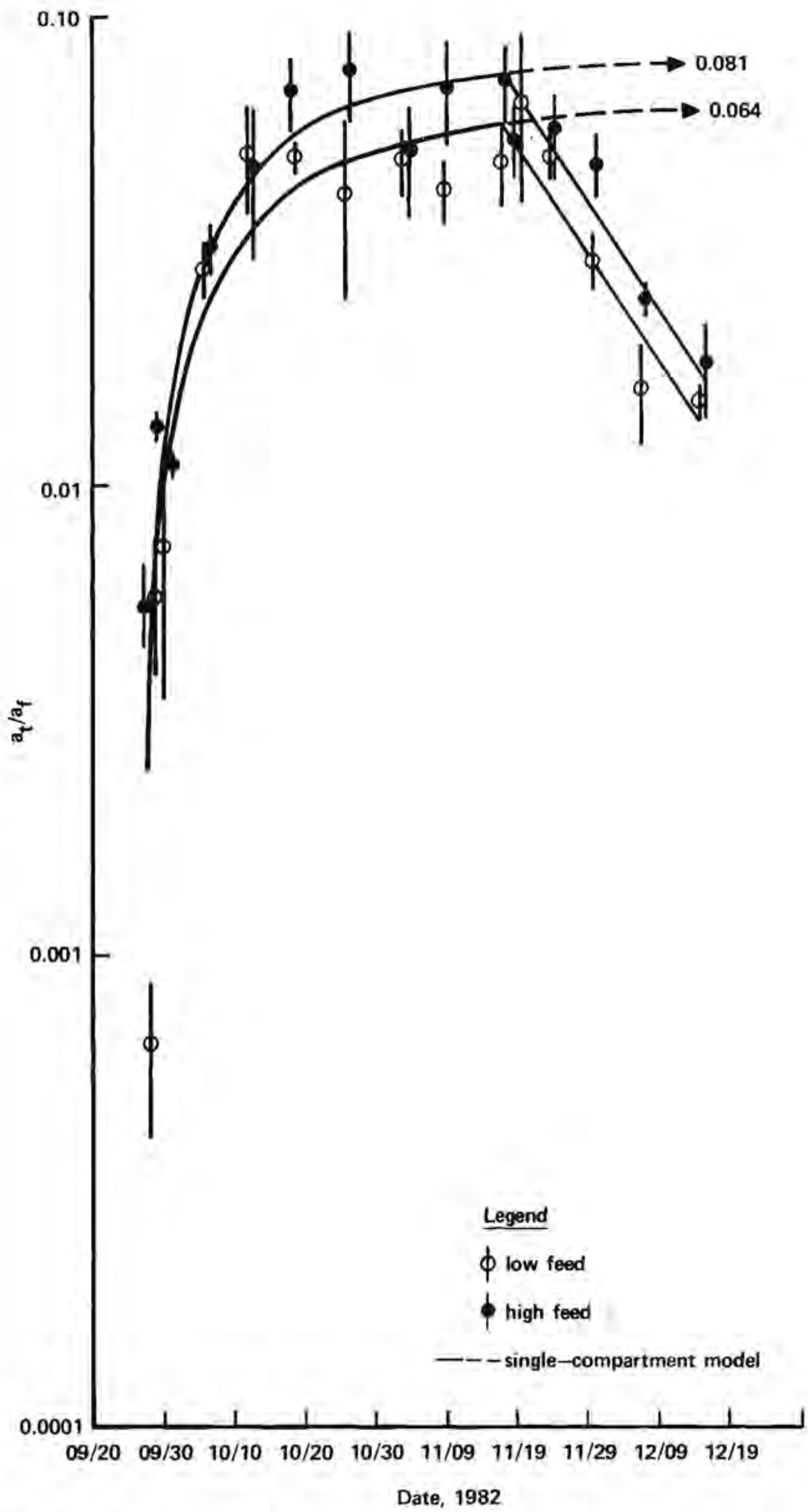


Fig. 1a. Phosphorus–32 specific activity in bluegill tissue relative to food: muscle

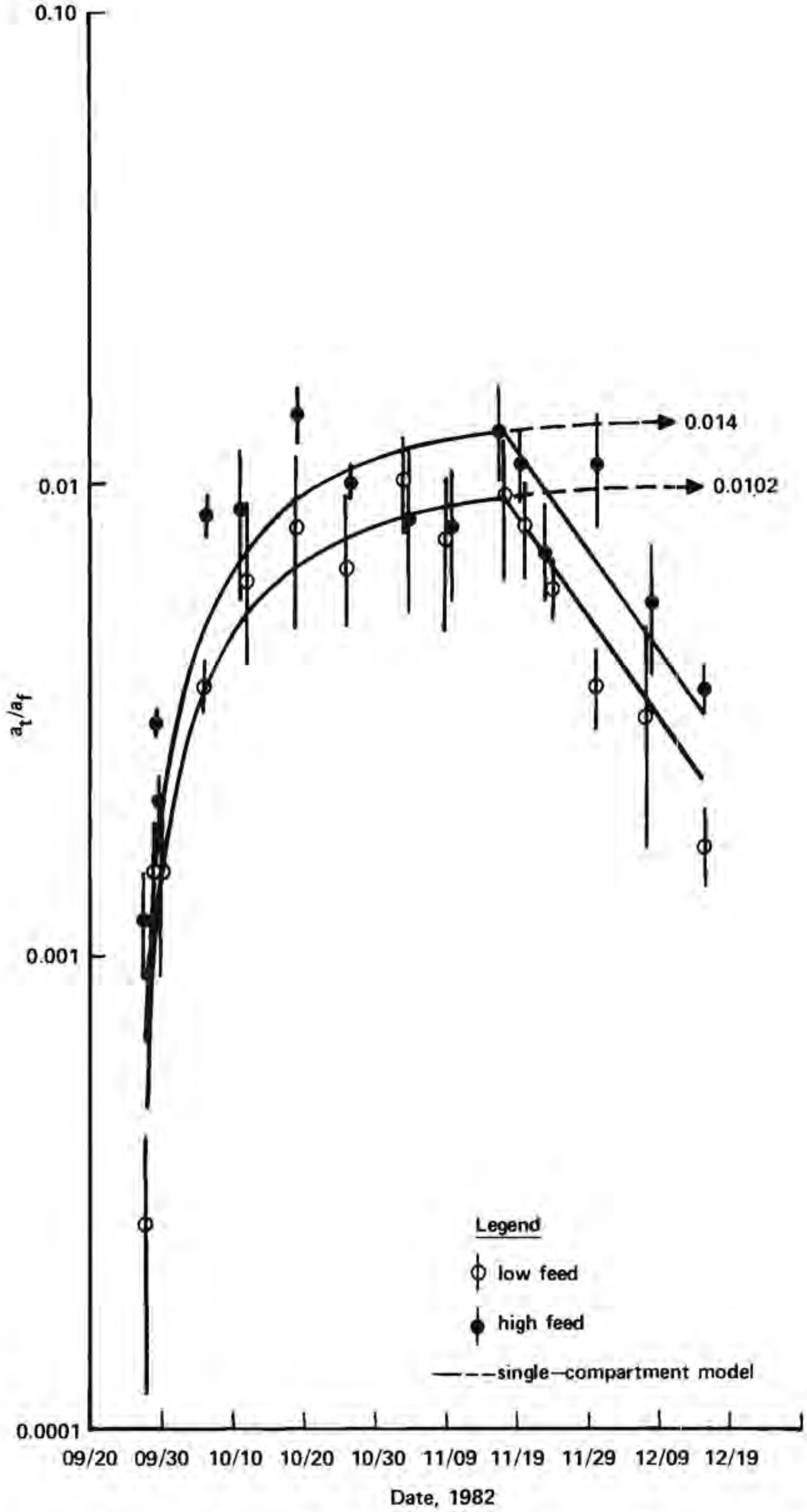


Fig. 1b. Phosphorus–32 specific activity in bluegill tissue relative to food: skeleton

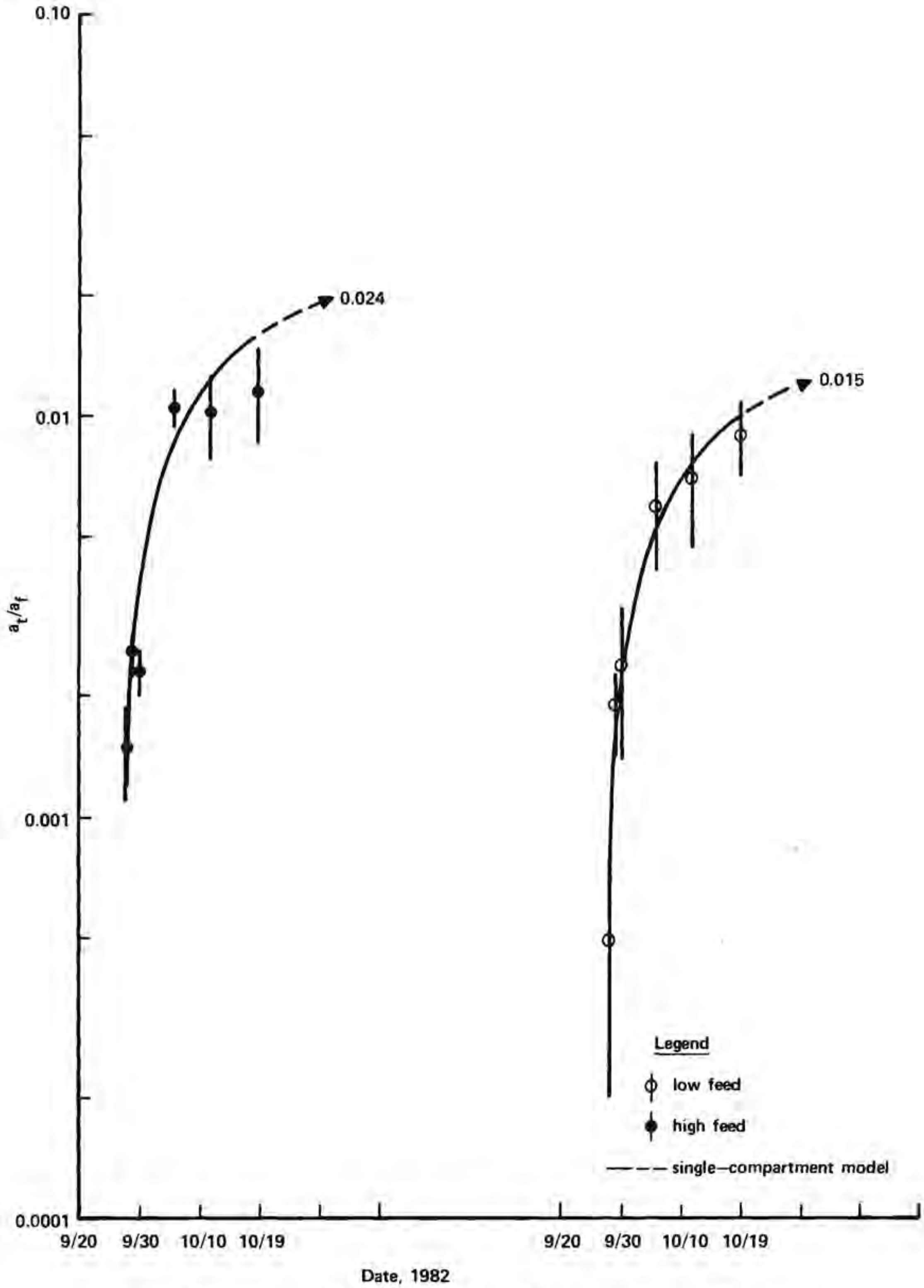


Fig. 1c. Phosphorus–32 specific activity in bluegill tissue relative to food: tail

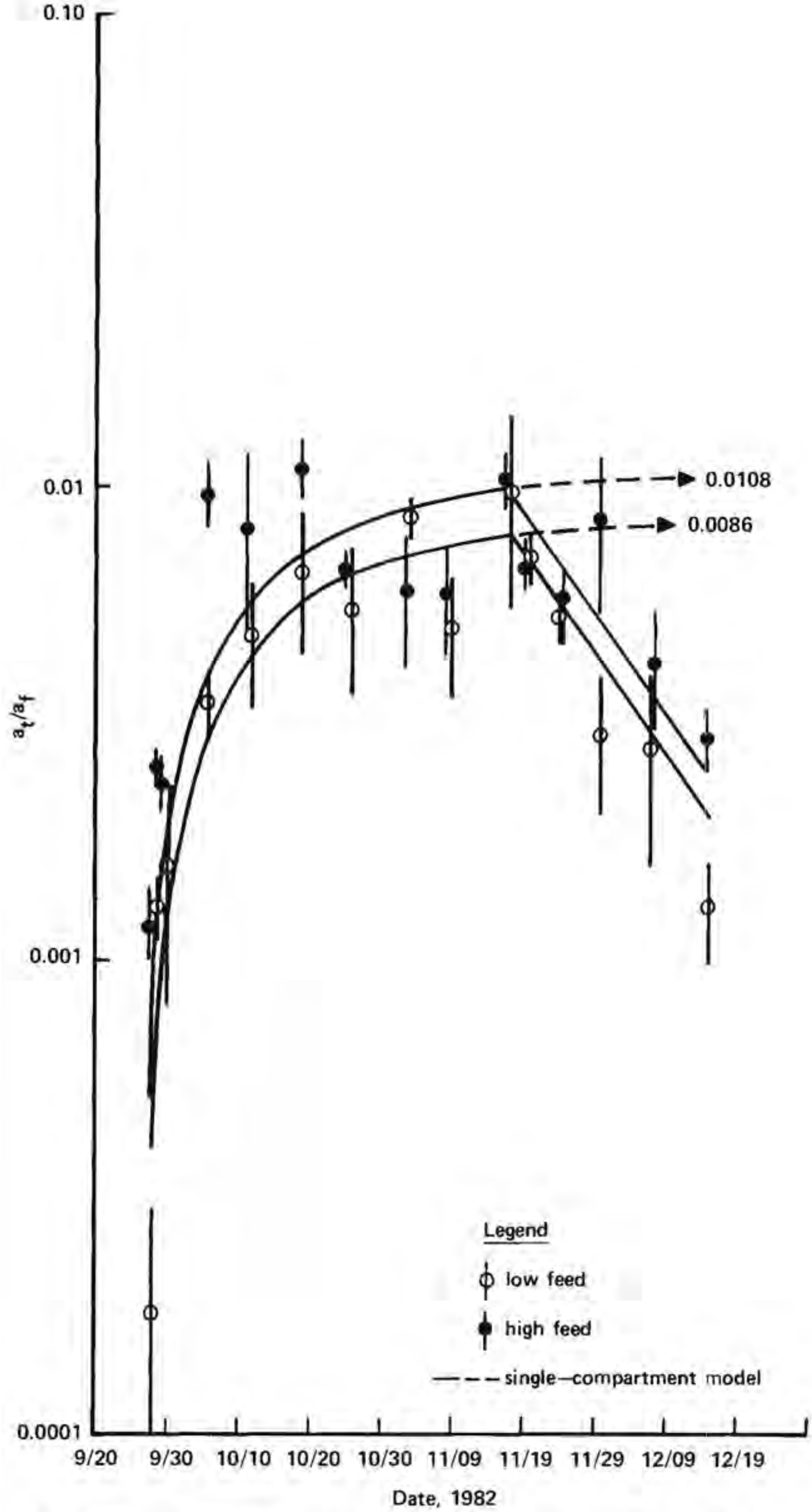


Fig. 1d. Phosphorus–32 specific activity in bluegill tissue relative to food: head

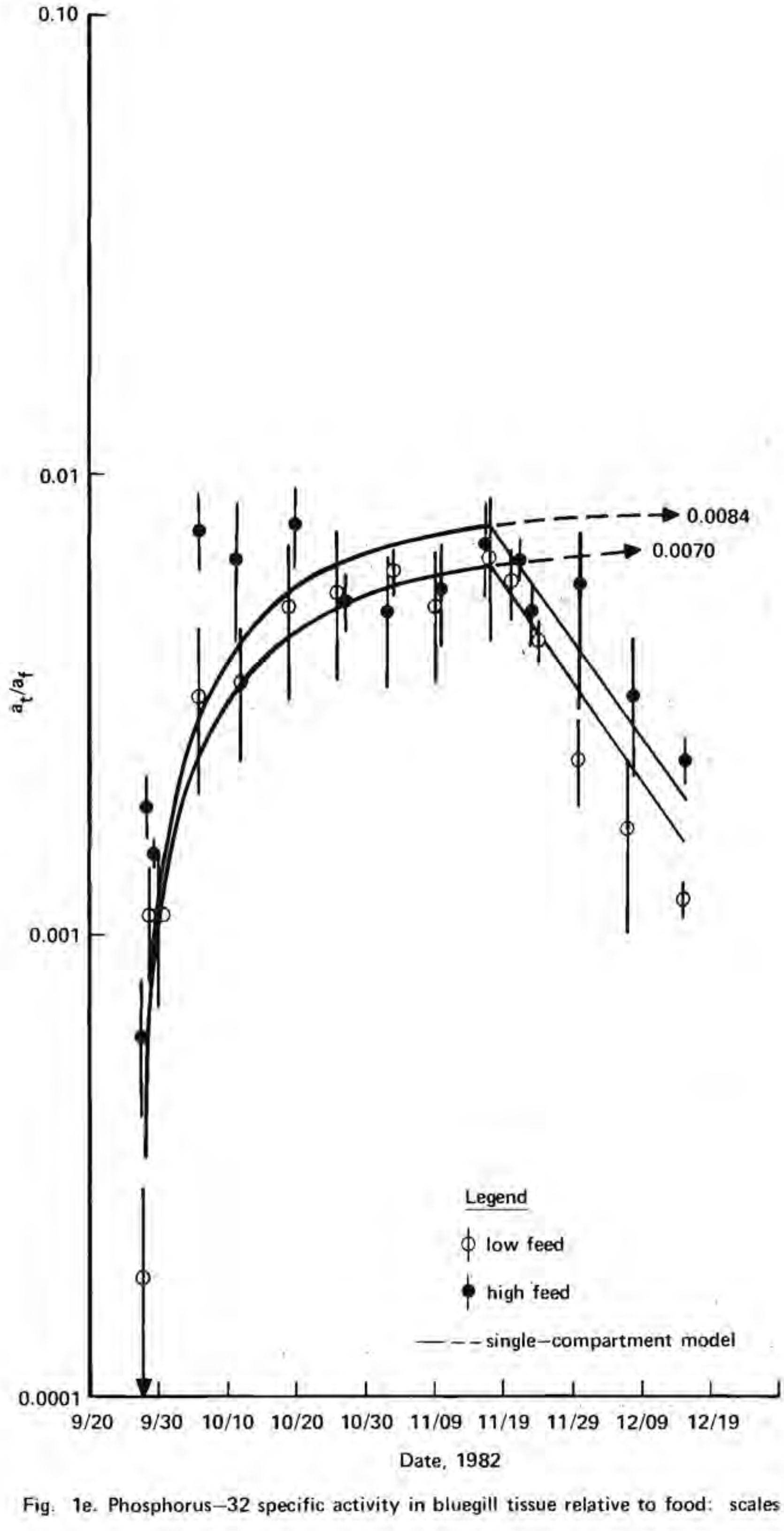


Fig. 1e. Phosphorus–32 specific activity in bluegill tissue relative to food: scales

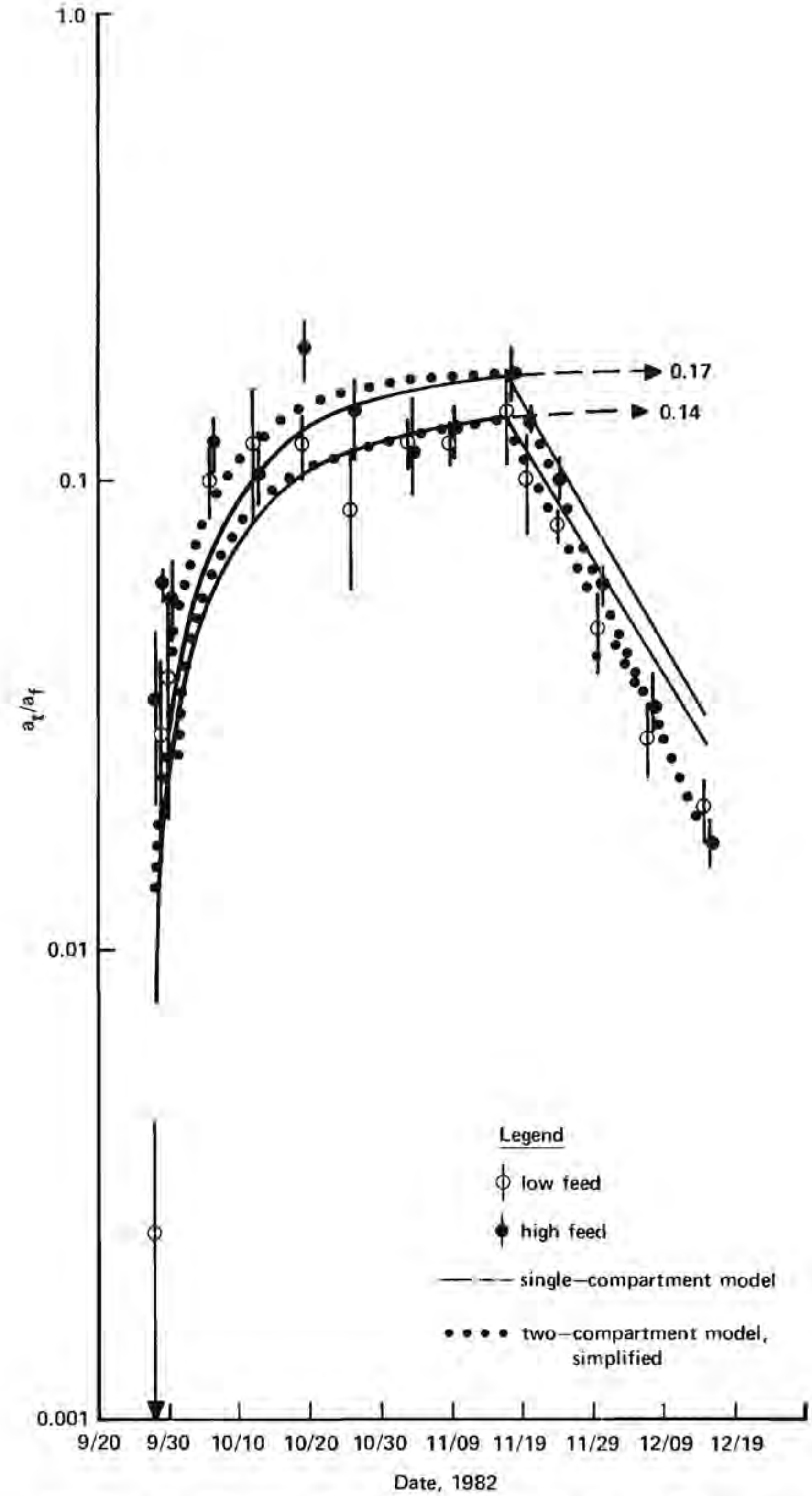


Fig. 1f. Phosphorus–32 specific activity in bluegill tissue relative to food: gills

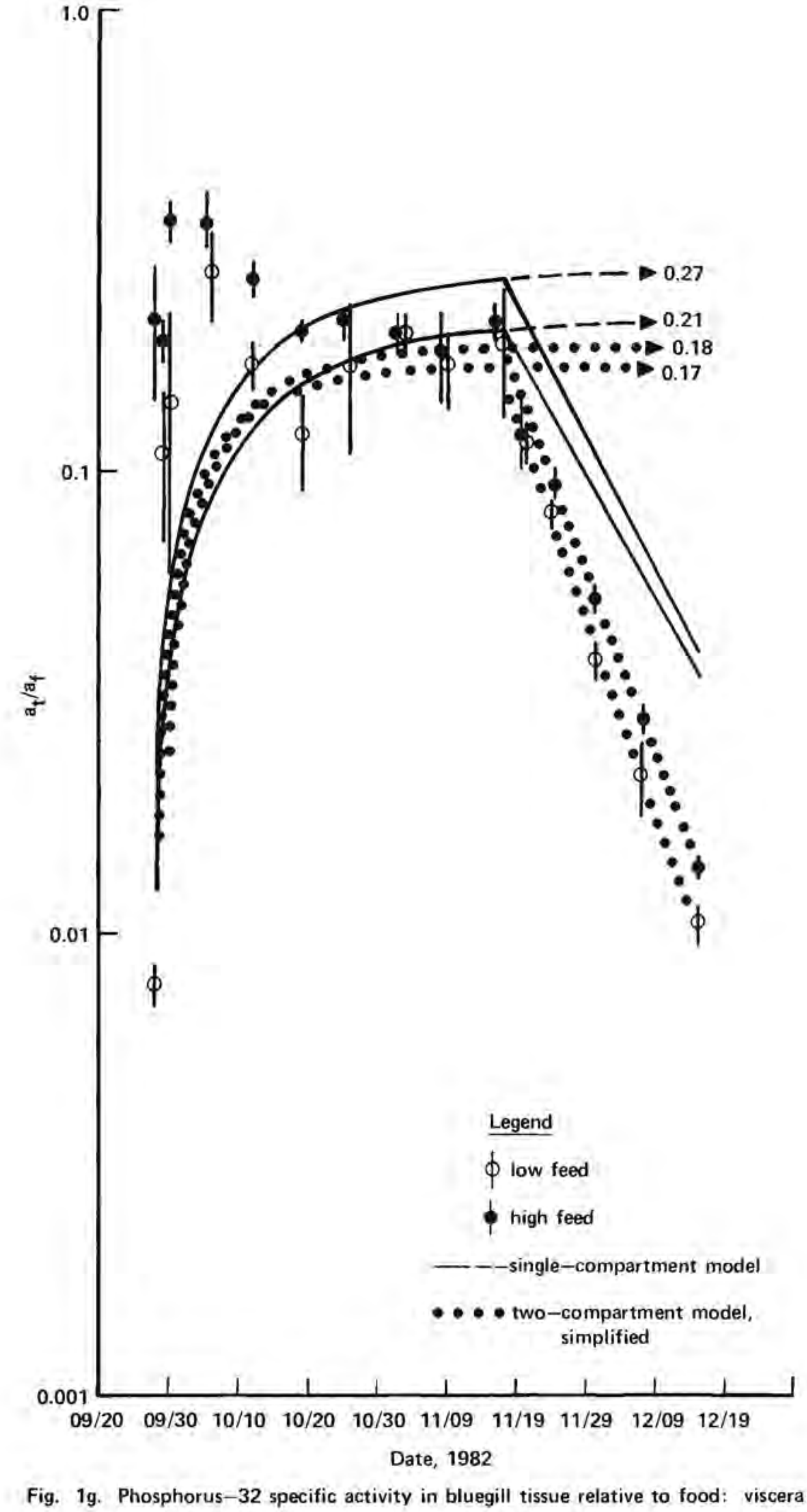


Fig. 1g. Phosphorus–32 specific activity in bluegill tissue relative to food: viscera

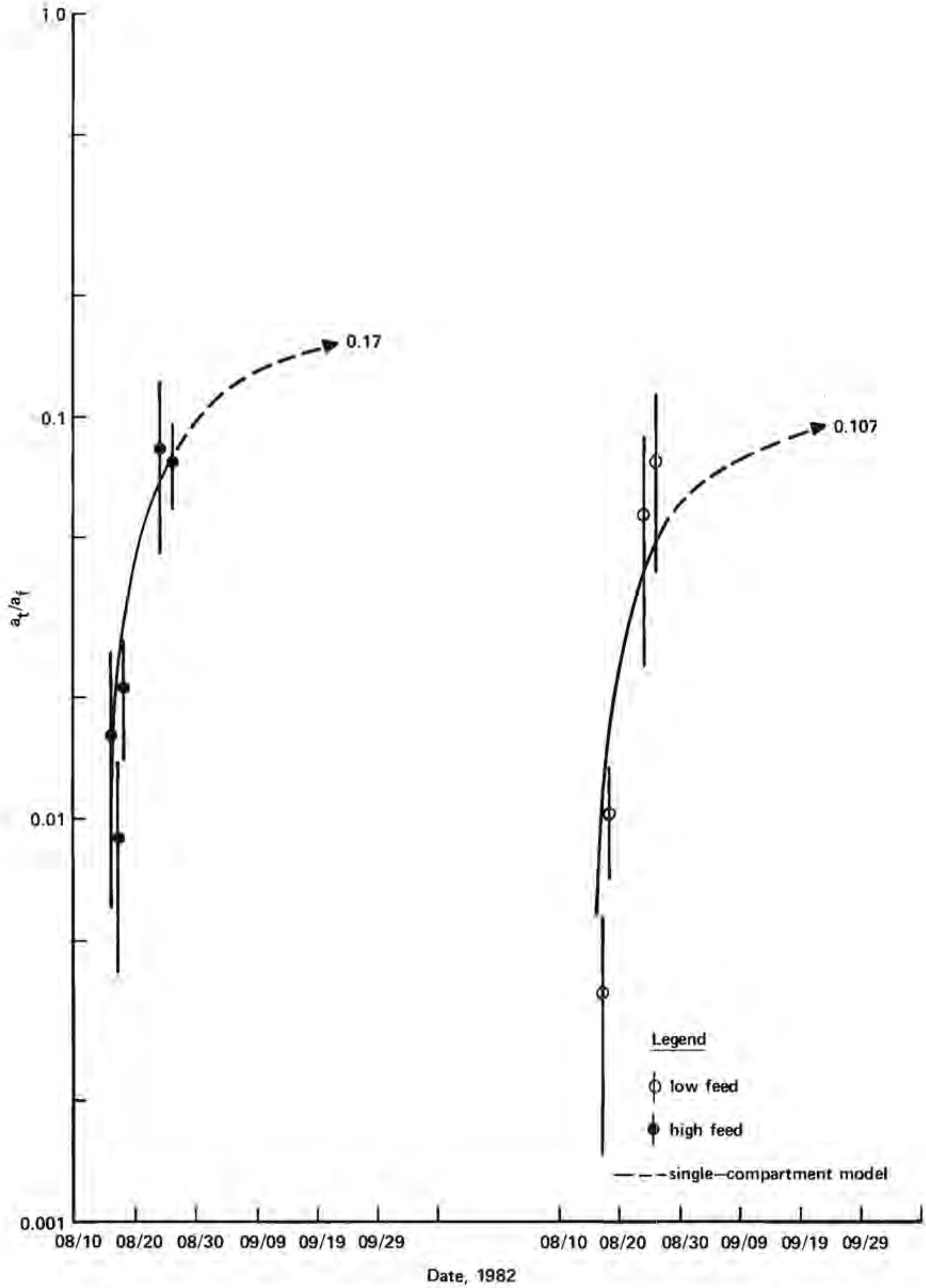


Fig. 2a. Phosphorus–32 specific activity in catfish tissue relative to food: muscle

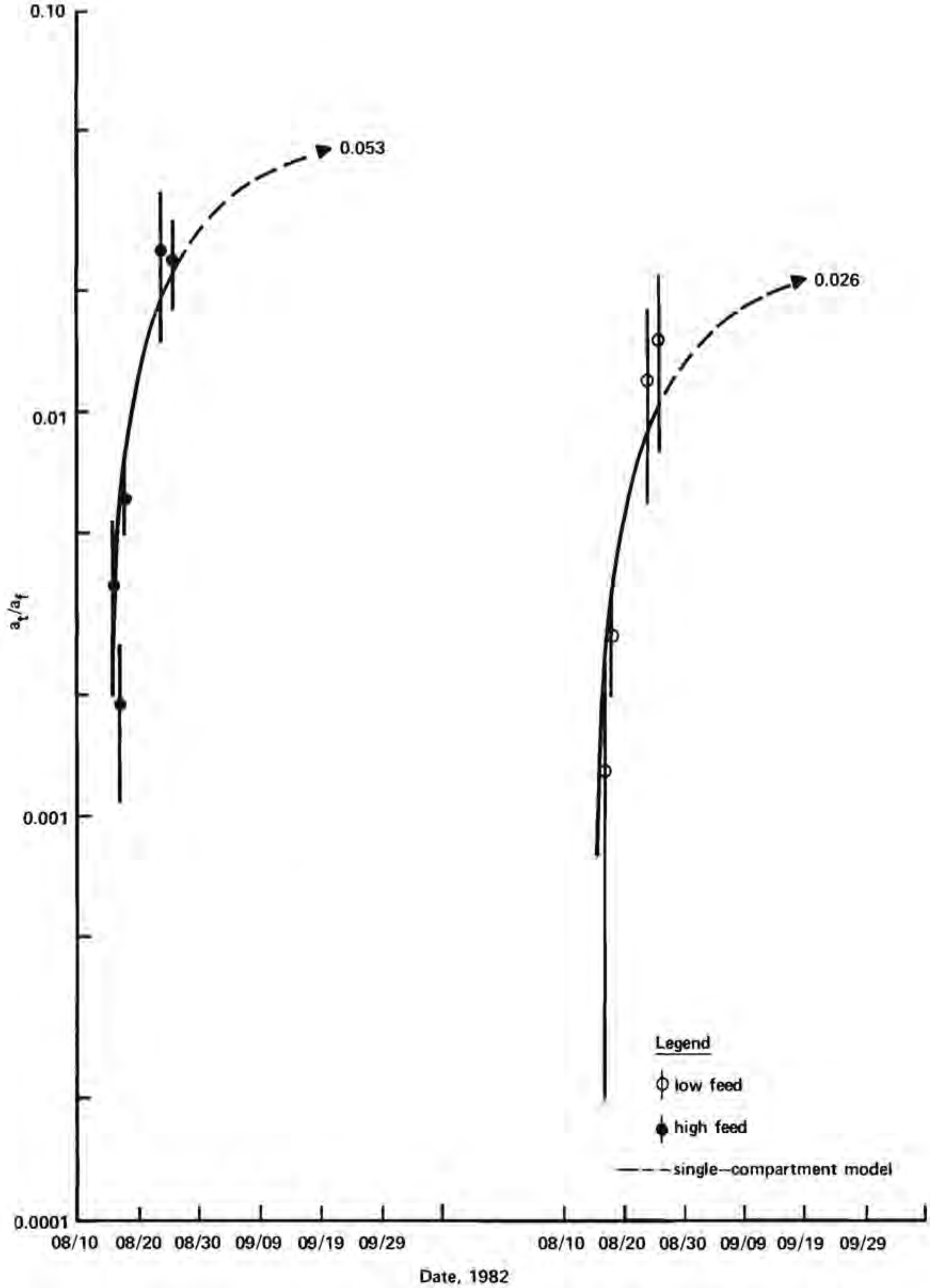


Fig. 2b. Phosphorus–32 specific activity in catfish tissue relative to food: skeleton

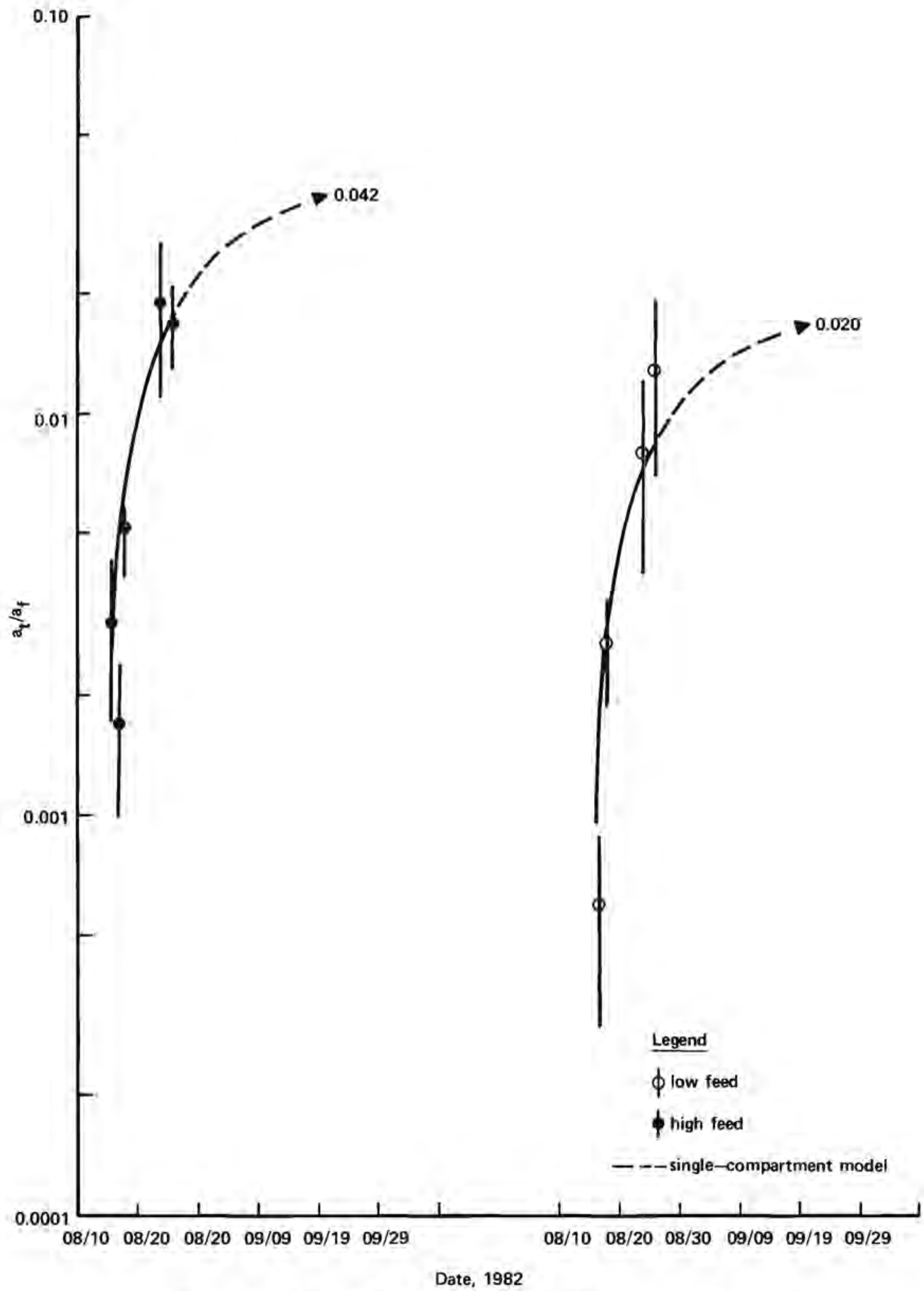


Fig. 2c. Phosphorus–32 specific activity in catfish tissue relative to food: head

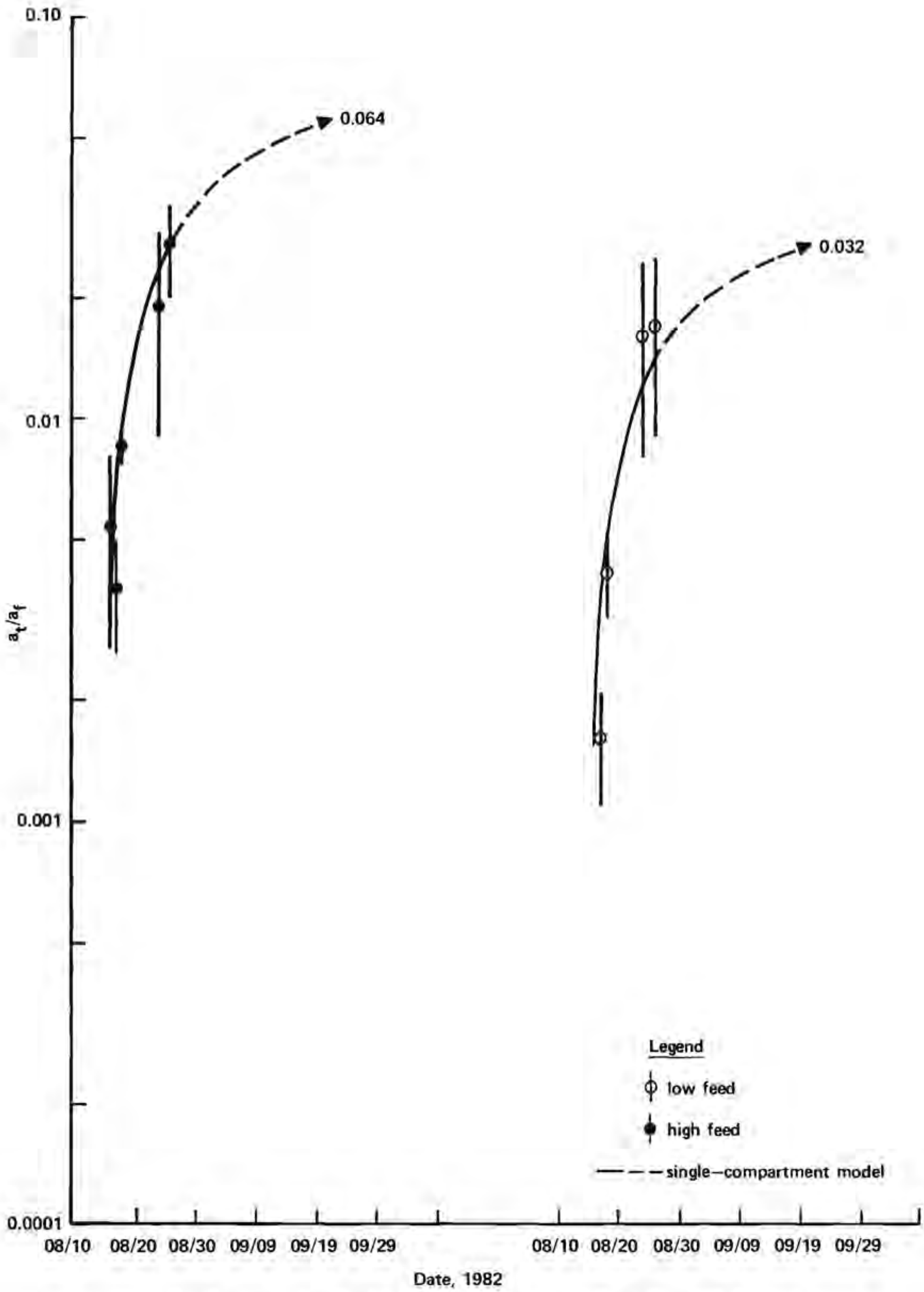


Fig. 2d. Phosphorus–32 specific activity in catfish tissue relative to food: fins

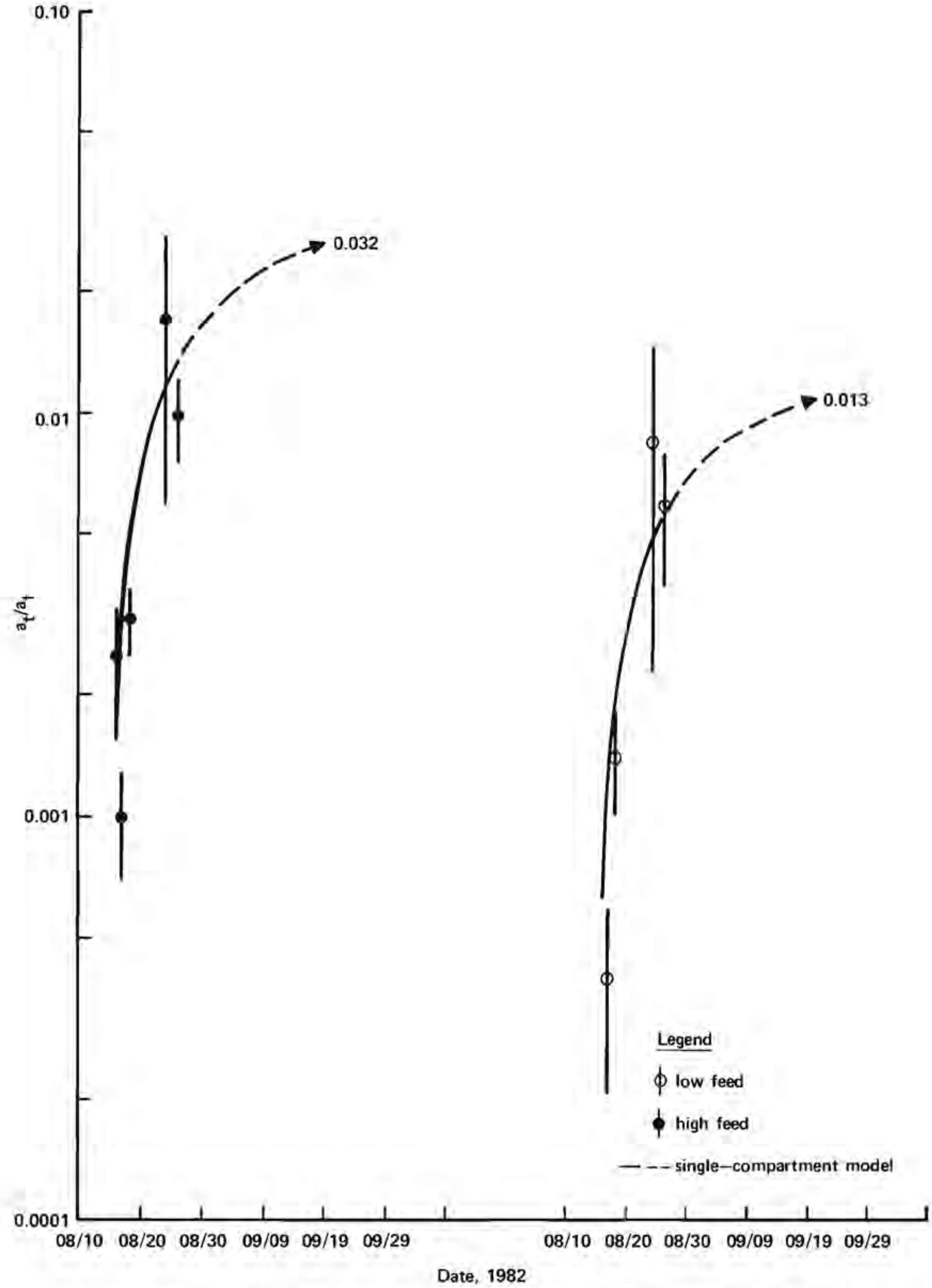


Fig. 2e. Phosphorus–32 specific activity in catfish tissue relative to food: fin spines

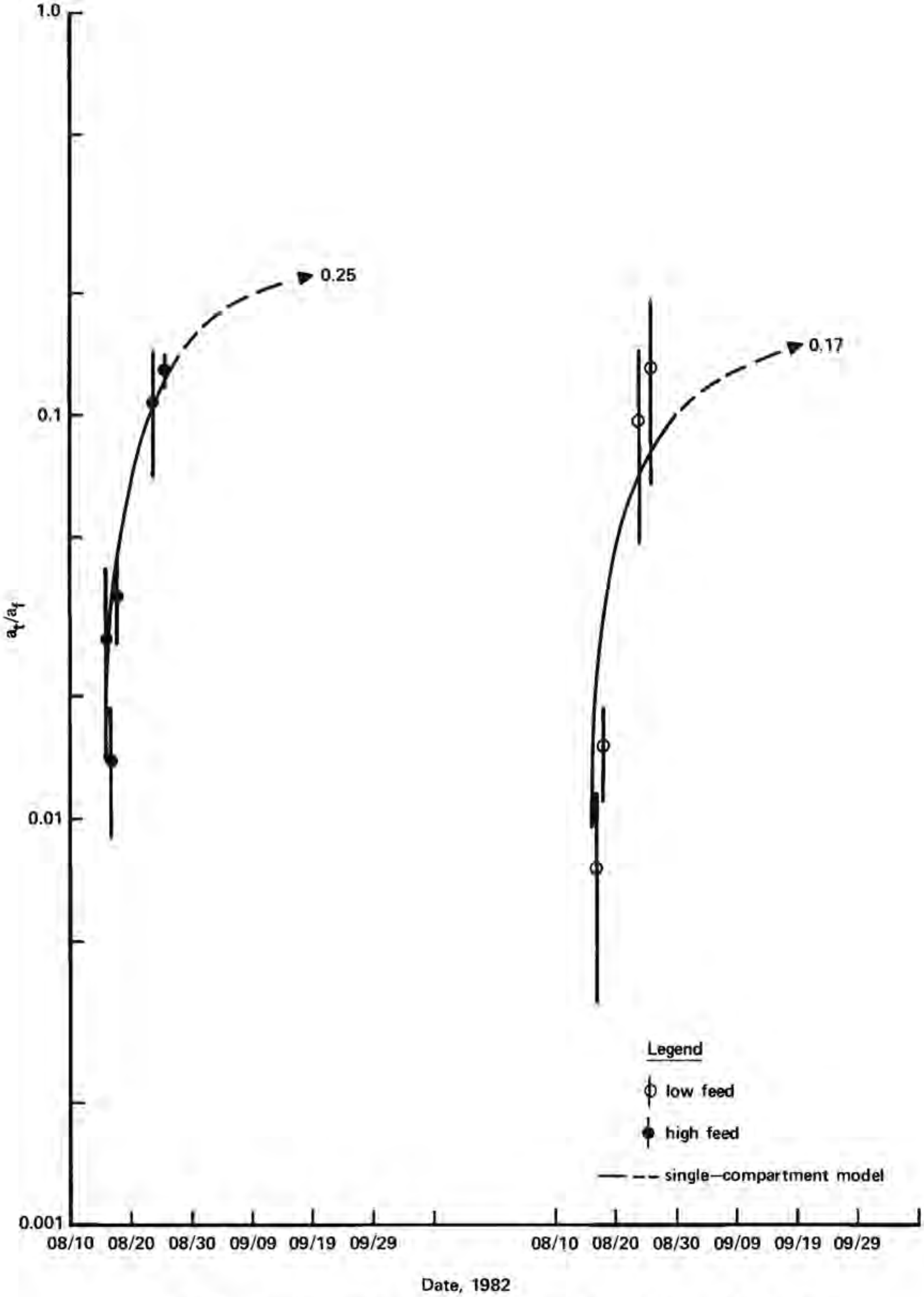


Fig. 2f. Phosphorus–32 specific activity in catfish tissue relative to food: skin

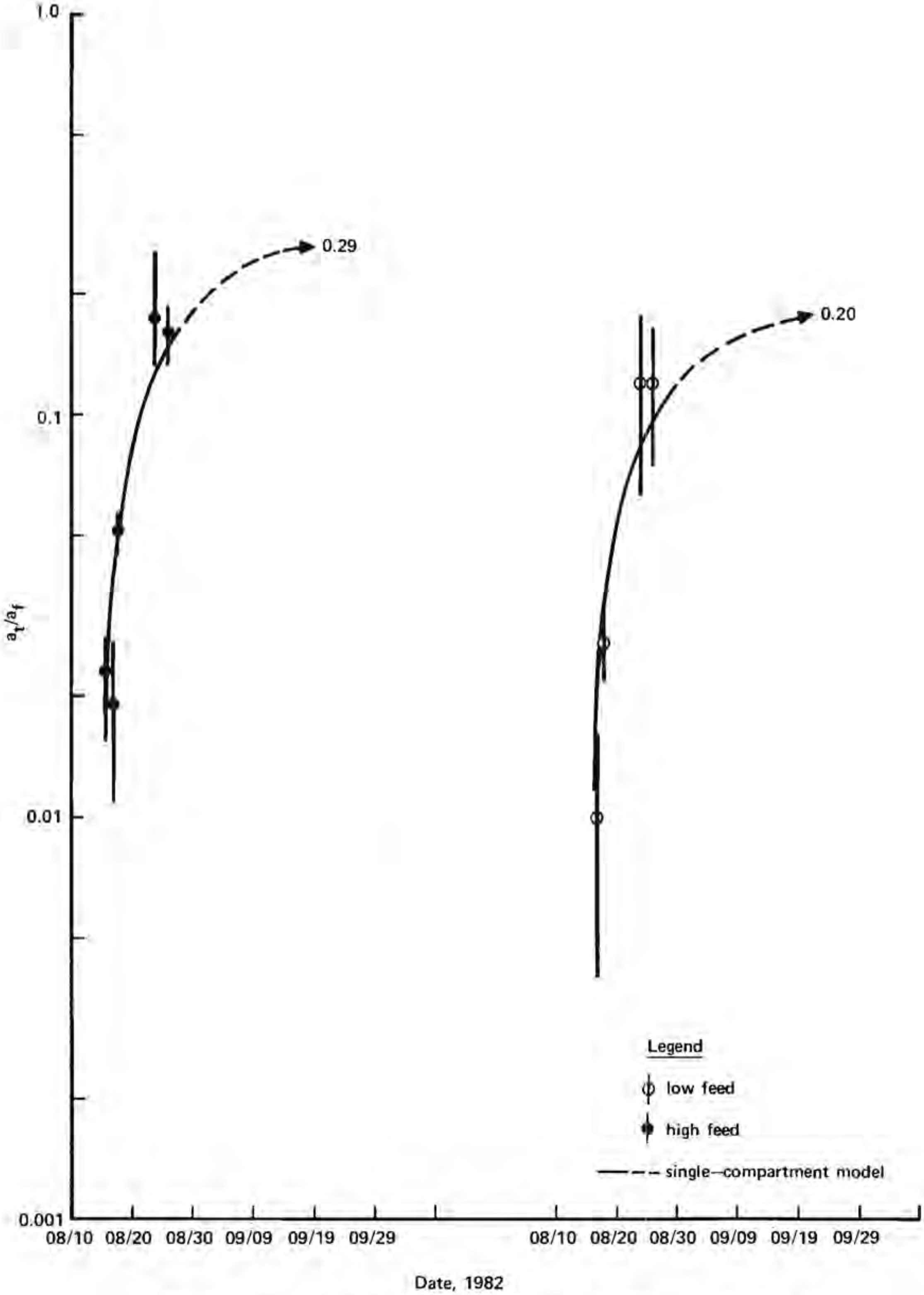


Fig. 2g. Phosphorus–32 specific activity in catfish tissue relative to food: gills

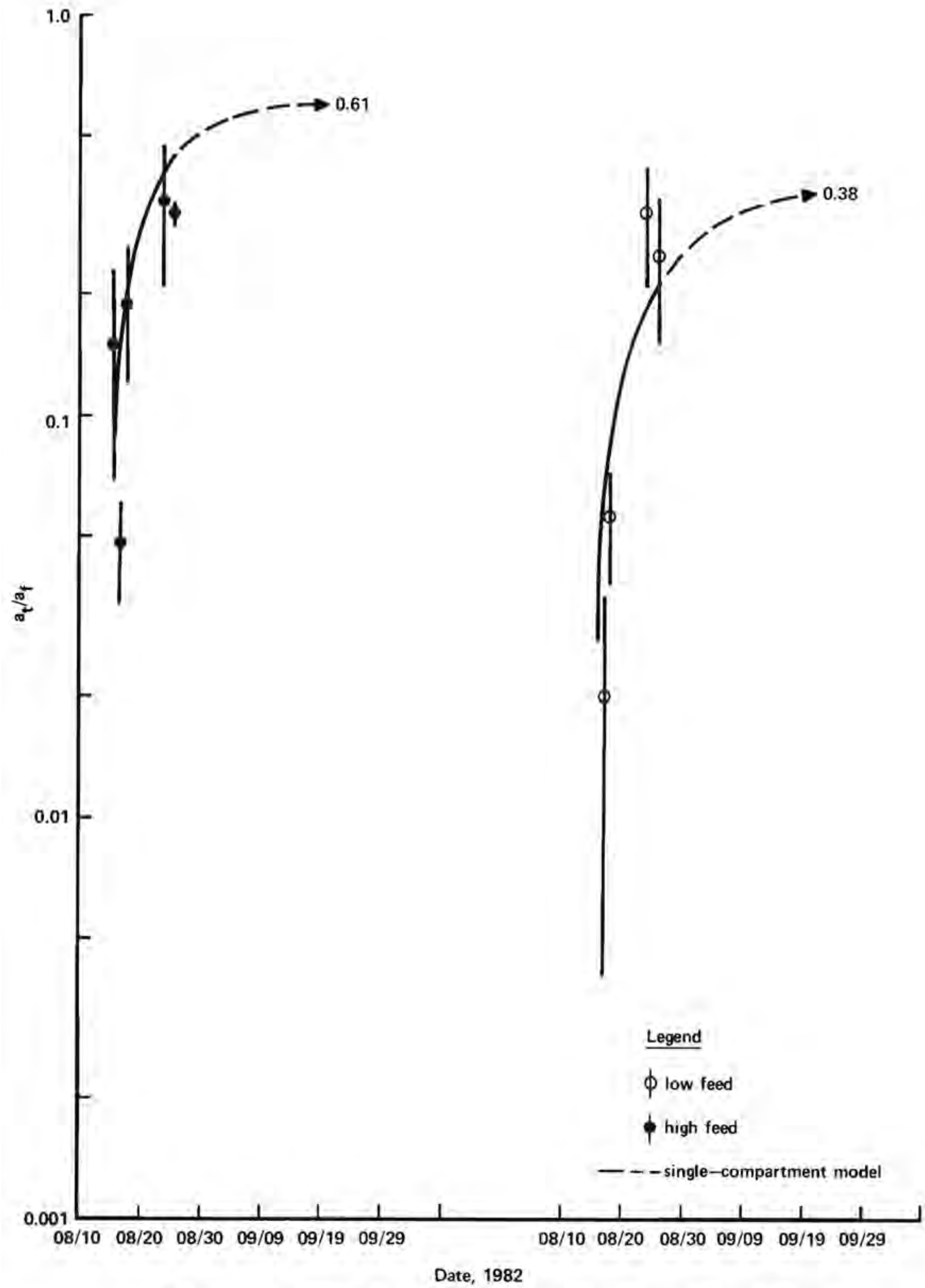


Fig. 2h. Phosphorus–32 specific activity in catfish tissue relative to food: viscera

APPENDICES

A.1-1
P-32 Uptake and Depuration in Bluegill
Muscle

Fish No.(1)	Date of death, 1982 (hr)	Weight,(2)			Sample No.	P-32				P, mg/g wet	P-32/P, c/min.mg.
		wet	dry	ashed		Date of counting, 1982 (hr)	decay fraction	net c/min.(3)	c/min.g. wet		
761E	09/28	22.5	4.10	277	285	10/12(18)	0.498	33.0	14.7	2.31	6.4
794E	(08)	23.1	3.48	307	326	10/15(05)	0.441	10.6	5.2	2.43	2.1
879E		34.3	6.23	398	314	10/14(21)	0.447	22.5	7.3	2.31	3.2
499W		16.3	2.42	169	315	10/14(23)	0.447	120	82.3	1.93	42.6
708W		30.7	5.53	403	334	10/19(10)	0.360	136	61.5	2.60	23.7
787W		29.1	5.75	347	325	10/14(12)	0.456	231	87.0	2.42	36.0
684E	09/29	42.3	7.74	470	452	11/02(18)	0.189	69.2	43.3	2.16	20.0
859E	(08)	31.8	--	333	443	11/02(17)	0.189	137.	114	2.14	53.3
863E		20.9	4.33	254	457	11/03(01)	0.186	54.4	70.0	2.27	30.8
608W		27.1	5.67	334	458	11/04(14)	0.173	183.	195	2.28	85.5
682W		39.1	7.47	424	444	11/03(11)	0.182	231.	162	2.16	75.0
890W		33.8	6.50	394	571	11/09(13)	0.136	233	243	3.01	80.7
619E	09/30	37.3	6.54	401	503	11/05(19)	0.170	28.0	22.1	2.03	11.1
872E	(08)	39.2	7.52	474	420	10/25(20)	0.291	248	109	2.43	44.9
635E		38.0	7.46	468	433	10/26(01)	0.288	381	174	2.25	77.3
706W		29.2	5.38	347	451	11/03(14)	0.191	204	183	2.63	69.6
704W		32.4	6.61	405	454	11/03(14)	0.191	192	155	2.49	62.3
480W		45.9	9.80	610	415	10/25(18)	0.292	429	160	2.41	66.4
759E	10/06	24.3	3.85	118(6)	532	11/06(18)	0.218	259	244	1.86	131
674E	(08)	20.1	4.05	266	584	11/09(15)	0.190	306	401	2.05	196
762E		28.6	5.94	339	459	11/03(15)	0.254	514	354	1.85	191
613W		33.4	7.25	417	460	11/03(15)	0.254	646	381	2.32	164
680W		22.2	4.73	256	466	11/04(11)	0.244	528	487	2.53	193
792W		32.1	7.12	396	549	11/07(22)	0.206	770	582	2.57	227
699E	10/12	29.9	5.31	357	597	11/10(12)	0.243	1,167	803	2.28	352
784E	(08)	35.7	6.88	455	494	11/04(17)	0.322	2,048	891	2.27	393
733E		21.0	3.59	228	475	11/04(14)	0.325	500	366	2.09	175
488W		34.2	6.90	398	518	11/04(22)	0.319	1,957	897	1.99	451
490W		23.0	4.72	302	586	11/09(16)	0.253	766	658	2.66	247
476W		40.0	8.00	497	523	11/04(22)	0.319	948	371	2.45	151

(1) W fish received twice as much feed as E fish, at same specific activity (2) Wet and dry weight in gram; ashed weight in mg. (3) Duplicate 20-ml aliquots of 100-ml samples were analyzed for P-32 by counting Cherenkov radiation for 50-min when < 200 c/min and for 10-min when > 200 c/min (4) Tail samples were combined with skeleton samples after 10/19 (5) Month 01 is in 1983 (6) Weight appears to be erroneous (7) For actual times of death on 11/09, 11/20, 11/24, 11/30, 12/07, and 12/15, see Appendix A.3

A.1-1 cont'd
P-32 Uptake and Depuration in Bluegill
Muscle

Fish No.	Date of death, 1982 (hr)	Weight, wet	dry	ashed	Sample No.	P-32: Date of counting, 1982 (hr)	decay fraction	net c/min	c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg.
769E	10/19	28.4	6.01	351	613	11/17(11)	0.244	1,044	753	2.35	320
482E	(08)	25.4	5.38	301	617	11/17(13)	0.243	735	595	1.96	304
677E		21.9(6)	2.79	198	556	11/08(08)	0.379	724	436	1.51(6)	289
497W		23.4	4.96	287	555	11/08(08)	0.379	1,640	925	2.56	361
873W		40.2	8.35	416	624	11/17(14)	0.243	2,770	1,418	2.62	541
607W		39.8	8.00	478	627	11/17(15)	0.243	1,770	915	2.64	347
876E	10/26	29.4	5.67	332	673	11/23(13)	0.255	1,121	748	2.18	343
763E	(08)	26.8	5.33	331	654	11/23(11)	0.255	1,118	818	2.34	350
881E		23.6	5.07	300	695	11/24(06)	0.246	177	152	2.63	57.8
785W		33.2	7.05	422	651	11/23(10)	0.256	1,592	937	2.39	392
716W		33.3	7.23	427	647	11/18(14)	0.325	2,660	1,229	1.97	624
875W		40.4	8.90	528	646	11/18(14)	0.325	2,450	933	2.64	353
882E	11/03	22.8	4.37	268	703	11/24(22)	0.351	1,200	750	2.46	305
456E	(08)	24.1	5.20	298	701	11/24(18)	0.354	1,095	642	2.59	248
627E		34.7	6.97	448	795	12/10(11)	0.166	1,427	1,239	2.65	468
858E		38.4	7.86	471	698	11/24(16)	0.356	1,569	574	2.65	217
722E		36.4	7.68	434	702	11/24(20)	0.352	1,452	567	2.28	249
884W		34.5	7.21	435	705	11/25(01)	0.349	1,939	805	2.47	326
672W		25.0	4.53	301	670	11/23(12)	0.375	765	408	2.26	181
679W		34.3	6.51	430	685	11/24(13)	0.358	2,438	993	2.30	406
799E	11/09	28.2	5.51	374	717	11/25(21)	0.448	2,213	875	2.45	357
790E	(08)	41.3	8.91	539	719	11/26(01)	0.444	2,355	642	2.50	257
486E		23.7	4.04	274	715	11/25(18)	0.451	689	323	2.14	151
602W		38.1	8.06	489	785	12/03(14)	0.308	1,334	568	2.36	241
893W		19.5	3.47	267	790	12/10(10)	0.221	1,155	1,342	2.50	537
798W		43.3	8.74	572	718	11/25(01)	0.466	5,069	1,256	2.61	481
899E	11/17	23.3	4.58	301	763	12/02(15)	0.477	1,971	887	2.44	364
713E	(08)	31.2	6.63	412	766	12/02(16)	0.476	2,293	772	2.35	329
880E		28.4	5.49	360	765	12/02(16)	0.476	1,240	459	2.33	197
886W		29.8	5.96	379	759	12/02(14)	0.477	3,781	1,330	2.34	568
622W		41.4	8.63	536	757	12/02(13)	0.477	3,515	890	2.44	365
698W		37.4	7.29	467	826	12/10(24)	0.317	2,024	854	2.38	359

A.1-1 cont'd
P-32 Uptake and Depuration in Bluegill
Muscle

Fish No.	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32: Date of counting, 1982(hr)(5)	P-32: decay fraction	P-32: net c/min	P-32: c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg.
782E	11/20	34.6	7.31	444	846	12/12(22)	0.334	1,646	712	2.34	304
767E	(08)	48.7	10.52	582	849	12/16(10)	0.282	1,406	512	2.47	207
728E		46.7	10.41	592	848	12/13(01)	0.333	4,081	1,312	1.97	666
715W		47.7	10.71	605	931	12/22(10)	0.211	1,454	722	2.73	265
889W		44.5	10.11	596	1017	12/31(24)	0.133	1,283	1,084	2.66	408
606W		43.2	9.64	548	847	12/12(23)	0.334	1,762	611	1.98	309
477E	11/24	39.4	8.26	483	876	12/16(20)	0.336	1,671	631	2.54	248
738E	(08)	31.3	6.39	431	845	12/12(20)	0.408	3,101	1,214	3.62	335
691E		49.0	10.37	640	881	12/16(22)	0.335	2,467	751	2.41	312
668W		34.1	7.40	438	878	12/16(21)	0.336	1,856	810	2.50	324
717W		22.9	5.00	325	932	12/22(10)	0.256	1,372	1,170	2.72	430
891W		43.5	9.12	583	868	12/16(17)	0.338	1,872	637	2.50	255
637E	11/30	37.0	7.52	450	853	12/16(11)	0.458	1,785	527	2.52	209
721E	(08)	24.7	4.88	316	852	12/16(11)	0.458	854	377	2.54	148
723E		31.5	6.25	385	885	12/16(23)	0.446	1,291	459	2.55	180
892W		56.5	12.12	720	880	12/16(21)	0.449	4,748	935	2.58	362
885W		31.7	7.02	406	877	12/16(20)	0.449	2,101	738	2.64	280
636W		52.2	11.10	670	851	12/16(11)	0.458	3,010	630	2.74	230
730E	12/07	38.7	8.04	478	898	12/18(03)	0.593	1,670	364	2.65	137
871E	(08)	32.7	6.64	377	897	12/18(01)	0.595	652	168	2.33	72.1
705E		30.4	5.41	367	896	12/17(23)	0.598	720	198	2.45	80.8
641W		34.9	7.30	456	900	12/18(09)	0.586	1,664	407	2.63	155
615W		45.6	8.62	527	895	12/17(22)	0.599	1,919	349	2.33	150
735W		32.1	6.71	404	901	12/17(08)	0.616	1,556	393	2.54	155
694E	12/15	24.7	4.44	373	1088	01/14(15)	0.230	236	208	2.44	85.2
485E	(08)	38.4	7.36	498	1025	01/01(14)	0.434	784	235	2.62	89.7
894E		54.1	11.22	716	1089	01/14(15)	0.230	634	255	2.61	97.7
692W		55.0	11.54	677	998	12/30(16)	0.476	1,921	367	2.51	146
854W		57.0	12.62	748	1090	01/14(15)	0.230	643	245	2.72	90.1
630W		35.6	7.63	472	1091	01/14(16)	0.230	353	216	2.50	86.4

A.1-1 cont'd
P-32 Uptake and Depuration in Bluegill
Skeleton

Fish No.(1)	Date of death, 1982 (hr)	Weight, wet	dry	ashed	Sample No.	P-32 Date of counting, 1982 (hr)	decay fraction	net c/min.	c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg.
761E	09/28	22.4	6.79	2,470	371	10/20(22)	0.334	89.3	59.7	17.6	3.39
794E	(08)	23.9	6.84	3,300	310	10/14(06)	0.463	34.7	15.7	24.1	0.65
879E		30.0	9.10	2,990	328	10/15(07)	0.439	34.9	13.2	17.5	0.75
499W		23.6	6.79	2,870	329	10/15(11)	0.439	302	146	19.9	7.34
708W		24.3	6.59	2,580	327	10/14(13)	0.456	191	86.2	20.3	4.25
787W		29.7	8.49	2,780	335	10/19(11)	0.360	338	158	15.8	10.0
684E	09/29	32.0	9.39	3,370	418	10/25(19)	0.264	160	94.7	20.0	4.74
859E	(08)	28.5	8.85	3,230	469	11/04(12)	0.173	222	225	20.6	10.9
863E		20.8	6.31	1,540	468	11/03(16)	0.184	120	157	13.9	11.3
608W		21.7	6.79	2,020	467	11/04(12)	0.173	212	282	16.3	17.3
682W		33.7	10.12	2,540	416	10/25(19)	0.264	491	276	14.3	19.3
890W		29.6	8.52	---	484	11/04(14)	0.173	329	321	16.2	19.8
619E	09/30	14.6	--	2,210	453	11/02(20)	0.197	31.4	54.6	22.4	2.44
872E	(08)	27.0	8.81	3.010	417	10/25(19)	0.291	390	248	21.4	11.6
635E		25.1	8.13	2,630	409	10/25(16)	0.293	419	285	21.0	13.6
706W		21.4	6.60	2,650	419	10/25(20)	0.291	306	246	20.4	12.1
704W		19.1	6.84	1,910	398	10/25(15)	0.294	309	275	17.7	15.5
480W		25.1	9.20	3,070	473	11/04(13)	0.182	232	254	23.8	10.7
759E	10/06	24.0	6.22	2,260	572	11/09(13)	0.191	280	305	16.8	18.2
674E	(08)	22.1	6.82	2,380	491	11/04(16)	0.242	520	486	18.9	25.7
762E		26.2	8.27	2,570	471	11/04(12)	0.243	529	415	17.5	23.7
613W		20.9	6.52	1,740	598	11/10(12)	0.182	560	736	15.1	48.7
680W		16.2	5.20	1,390	449	11/03(13)	0.255	743	899	15.6	57.6
792W		22.9	7.48	1,700	567	11/10(10)	0.183	614	733	15.8	46.4
699E	10/12	33.9	9.01	3,400	566	11/09(12)	0.255	1,054	610	18.1	33.7
784E	(08)	32.8	9.35	2,920	541	11/07(09)	0.283	1,720	926	14.3	64.8
733E		22.5	5.59	2,390	447	11/03(12)	0.341	506	330	16.3	20.2
488W		20.9	6.70	1,710	564	11/09(11)	0.255	1,399	1,313	16.4	80.1
490W		19.2	5.83	1,880	548	11/07(21)	0.277	672	632	12.7	49.8
476W		30.4	8.64	3,140	596	11/10(11)	0.244	726	489	18.4	26.6

A.1-1 cont'd
P-32 Uptake and Depuration in Bluegill
Skeleton

Fish No.	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32: Date of counting, 1982 (hr)	P-32: decay fraction	P-32: net c/min	P-32: c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg.
769E	10/19	23.2	7.15	1,970	554	11/08(07)	0.380	1,539	873	14.0	62.4
482E	(08)	21.4	6.66	1,590	562	11/09(10)	0.360	1,119	726	12.9	56.3
677E		19.9	5.50	2,620	594	11/10(11)	0.343	806	590	23.7	24.9
497W		18.7	5.39	1,290	553	11/08(05)	0.382	1,645	1,151	13.5	85.3
873W		36.9	10.36	2,860	561	11/09(10)	0.360	3,675	1,383	13.7	100.9
607W		39.7	11.81	3,720	592	11/09(16)	0.356	2,444	865	13.9	62.2
876E	10/26	22.4	7.00	2,060	683	11/23(16)	0.254	1,207	1,061	16.3	65.1
763E	(08)	27.5	9.00	3,640	773	12/03(11)	0.158	811	933	26.8	34.8
881E		18.1	5.62	1,650	743	12/02(11)	0.165	194	325	17.5	18.6
785W		30.8	9.37	3,020	687	11/24(14)	0.243	1,449	968	17.3	56.0
716W		34.9	10.56	3,390	688	11/24(14)	0.243	1,981	1,168	17.9	65.3
875W		33.0	10.38	3,320	749	12/02(12)	0.165	1,196	1,098	18.4	59.6
882E	11/03	23.7	7.00	2,630	788	12/10(09)	0.166	689	876	20.4	42.9
456E	(08)	22.7	7.12	1,730	770	12/03(10)	0.232	1,211	1,150	14.0	82.1
627E		33.5	9.83	3,420	787	12/10(09)	0.166	1,295	1,164	18.0	64.7
858E		32.3	9.93	2,680	678	11/23(15)	0.374	1,855	768	14.6	52.6
722E		28.1	8.98	2,050	786	12/10(08)	0.166	802	860	12.5	68.8
884W		25.6	8.05	4,210(6)	771	12/03(11)	0.232	1,326	1,116	14.3	78.0
672W		24.0	6.96	2,890	747	12/02(12)	0.243	633	543	20.5	26.5
679W		34.1	10.31	4,080	793	12/10(11)	0.166	1,131	1,002	21.3	47.0
799E	11/09	24.3	7.36	2,630	730	11/26(18)	0.430	2,023	968	20.0	48.4
790E	(08)	24.5	8.47	2,090	724	11/26(09)	0.438	2,414	1,126	16.2	69.5
486E		26.4	8.07	3,280	767	12/03(09)	0.310	643	393	20.1	20.0
602W		27.8	9.47	2,300	731	11/26(20)	0.427	1,765	743	15.2	48.8
893W		24.2	8.32	3,750	768	12/03(10)	0.310	1,462	974	29.7	32.8
798W		35.2	11.03	3,450	733	11/26(23)	0.425	3,807	1,272	20.2	63.0
899E	11/17	29.7	8.31	2,810	822	12/10(17)	0.322	2,013	1,052	18.2	57.8
713E	(08)	18.7	6.02	1,610	824	12/10(21)	0.320	1,679	1,403	17.3	81.1
880E		25.4	7.64	2,860	817	12/10(15)	0.323	1,002	611	21.1	29.0
886W		31.9	9.26	3,000	828	12/11(16)	0.308	3,197	1,627	18.8	86.5
622W		30.6	9.06	2,520	835	12/12(04)	0.299	2,802	1,531	15.0	102.0
698W		31.0	9.07	3,200	816	12/10(14)	0.323	2,083	1,040	19.0	54.7

A.1-1 cont'd
P-32 Uptake and Depuration in Bluegill
Skeleton

Fish No.	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32: Date of counting, 1982 (hr)	P-32: decay fraction	P-32: net c/min	P-32: c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg.
782E	11/20	37.5	10.08	3,130	858	12/16(13)	0.281	1,443	685	16.7	41.0
767E	(08)	33.8	10.18	3,100	1013	12/31(18)	0.134	654	722	19.7	36.6
728E		34.1	10.26	3,290	1016	12/31(23)	0.133	1,038	1,144	16.8	68.1
715W		31.1	10.26	3,090	832	12/11(22)	0.351	1,850	847	17.7	47.9
889W		40.0	12.00	3,480	834	12/12(02)	0.348	3,993	1,434	16.7	85.9
606W		52.8	14.51	3,990	857	12/16(13)	0.281	3,028	1,020	15.3	66.6
477E	11/24	30.8	9.68	2,860	875	12/16(20)	0.336	1,419	686	17.0	40.4
738E	(08)	23.0	7.38	2,870	856	12/16(12)	0.341	989	630	23.3	27.0
691E		29.7	9.52	3,160	936	12/22(12)	0.255	1,374	907	21.7	41.8
668W		37.7	11.59	3,640	855	12/16(12)	0.341	1,809	704	21.1	33.4
717W		26.7	8.41	2,740	864	12/16(15)	0.339	2,037	1,125	18.8	59.8
891W		26.0	8.18	2,830	907	12/18(18)	0.306	1,076	676	19.1	35.4
637E	11/30	30.7	9.25	2,930	1043	01/07(12)	0.157	535	555	22.0	25.2
721E	(08)	24.0	7.68	2,890	866	12/16(16)	0.452	677	312	22.2	14.1
723E		25.4	7.93	2,650	862	12/16(14)	0.456	1,040	449	17.6	25.5
892W		45.2	14.97	4,300	867	12/16(17)	0.452	4,706	1,152	16.1	71.6
885W		20.9	6.65	1,460	939	12/22(12)	0.341	1,673	1,175	12.4	94.8
636W		30.5	10.21	3,440	1035	01/02(06)	0.213	1,025	788	19.1	41.3
730E	12/07	26.0	7.97	2,420	1006	12/31(06)	0.314	826	506	14.4	35.1
871E	(08)	26.1	7.77	2,210	966	12/23(10)	0.459	523	218	15.0	14.5
705E		30.0	8.98	3,570	987	12/23(13)	0.456	444	162	19.2	8.44
641W		21.4	6.64	1,840	1000	12/30(20)	0.320	789	576	15.3	37.6
615W		28.1	8.54	3,160	979	12/23(12)	0.457	875	341	19.9	17.1
735W		27.3	8.31	1,960	1002	12/30(24)	0.318	1,170	674	14.4	46.8
694E	12/15	26.1	7.38	3,140	1083	01/07(15)	0.323	299	177	21.3	8.31
485E	(08)	33.1	10.08	3,890	1026	01/01(16)	0.432	600	210	24.3	8.64
894E		37.4	11.21	3,550	992	12/30(07)	0.484	907	251	18.8	13.4
692W		39.1	12.26	3,700	1030	01/01(22)	0.426	1,089	327	17.7	18.5
854W		28.3	9.67	2,490	993	12/30(08)	0.483	1,069	391	16.1	24.3
630W		26.0	8.11	1,660(6)	1102	01/14(18)	0.229	337	283	12.1	23.4

A.1-1 cont'd
P-32 Uptake and Depuration in Bluegill
Viscera

Fish No.(1)	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32: Date of counting, 1982 (hr)	P-32: decay fraction	P-32: net c/m(2)	P-32: c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg.
761E	09/28	8.4	1.20	104	305	10/13(13)	0.481	747	92.4	2.08	44.4
794E	(08)	6.6	1.08	128(6)	288	10/12(22)	0.493	66.2	102	2.37	43.0
879E		11.2	2.54	136	343	10/20(00)	0.349	95.6	122	2.28	53.5
499W		10.5	1.33	113	301	10/13(12)	0.481	2,515	2,490	1.61	1,546
708W		10.9	1.55	119	298	10/13(10)	0.481	3,119	2,970	1.77	1,677
787W		16.3	3.56	201	320	10/14(11)	0.458	1,855	1,242	2.46	504
684E	09/29	8.6	1.55	101	410	10/25(17)	0.279	377	786	1.99	395
859E	(08)	13.4	1.80	126	374	10/21(13)	0.341	1,518	1,650	1.42	1,162
863E		5.7	0.97	60.0	406	10/25(16)	0.279	253	795	1.77	449
608W		7.2	1.30	68.9	377	10/21(14)	0.341	783	1,595	1.62	985
682W		9.4	2.60	82.8	368	10/21(13)	0.341	1,071	1,671	1.44	1,160
890W		11.3	1.61	110	405	10/25(16)	0.279	1,374	2,180	1.67	1,305
619E	09/30	6.4	1.34	67.2	403	10/21(11)	0.360	84.6	184	2.18	84.4
872E	(08)	11.1	1.79	128	381	10/25(12)	0.295	1,596	2,440	1.68	1,452
635E		11.5	1.75	140	375	10/21(14)	0.358	2,046	2,480	2.42	1,025
706W		12.1	1.71	118	404	10/25(16)	0.293	2,390	3,370	1.68	2,006
704W		10.0	3.13	88.7	380	10/25(11)	0.295	1,623	2,750	1.34	2,050
480W		12.0	2.42	116	369	10/21(13)	0.358	3,077	3,580	1.54	2,320
759E	10/06	5.0	0.83	69.4	465	11/03(16)	0.253	1,040	4,110	2.12	1,939
674E	(08)	7.9	1.15	90.2	462	11/03(16)	0.253	1,392	3,480	1.78	1,955
762E		6.7	1.30	86.9	606	11/17(11)	0.130	458	2,630	2.60	1,012
613W		5.6	0.72	---	602	11/10(13)	0.182	770	3,780	2.22	1,702
680W		4.6	1.10	55.4	485	11/04(14)	0.242	1,023	4,600	2.14	2,150
792W		7.2	2.64	76.1	488	11/04(14)	0.242	1,485	4,260	1.93	2,210
699E	10/12	8.7	1.50	126	510	11/04(20)	0.322	1,570	2,800	2.87	976
784E	(08)	8.9	1.68	105	577	11/09(14)	0.254	1,198	2,650	2.19	1,210
733E		4.3	0.65	57.2	516	11/04(21)	0.322	496	1,791	2.14	837
488W		5.9	1.93	63.3	580	11/09(14)	0.254	925	3,090	2.07	1,493
490W		7.0	1.35	73.6	513	11/04(21)	0.322	1,388	3,080	1.91	1,613
476W		11.4	1.61	146	537	11/07(02)	0.287	1,590	2,430	1.51	1,609

A.1-1 cont'd
P-32 Uptake and Depuration in Bluegill
Viscera

Fish No.	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32 Date of counting, 1982 (hr)	P-32 decay fraction	P-32 net c/min	P-32 c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg.
769E	10/19	6.3	1.41	71.4	615	11/17(12)	0.243	596	1,947	2.27	858
482E	(08)	5.3	1.63	53.1	614	11/17(12)	0.243	385	1,485	1.76	844
677E		6.2	0.85	84.6	625	11/17(14)	0.242	294	980	2.28	430
497W		6.5	1.32	74.6	610	11/17(11)	0.243	695	2,200	1.81	1,215
873W		12.1	2.17	151	622	11/17(14)	0.242	1,418	2,420	2.01	1,204
607W		14.4	2.30	162	605	11/10(13)	0.341	2,256	2,300	1.90	1,211
876E	10/26	7.0	1.53	85.5	692	11/24(15)	0.242	1,213	3,580	2.42	1,479
763E	(08)	11.7	1.85	158	699	11/24(16)	0.242	1,468	2,590	2.55	1,016
881E		3.9	0.84	44.9	700	11/24(16)	0.242	240	1,271	2,45	519
785W		11.7	1.98	138	713	11/25(14)	0.231	1,428	2,640	2.25	1,173
716W		11.1	1.98	127	640	11/18(13)	0.325	1,847	2,560	2.13	1,202
875W		9.2	1.92	114	638	11/18(12)	0.325	1,905	3,180	2.22	1,432
882E	11/03	8.1	1.30	86.3	779	12/03(13)	0.231	1,187	3,170	2.06	1,539
456E	(08)	4.0	0.95	32.9	775	12/03(12)	0.231	348	1,833	2.06	890
627E		8.0	1.49	118	804	12/10(12)	0.165	679	2,570	2.86	899
858E		8.0	2.19	68.5	780	12/03(13)	0.231	799	2,160	1.60	1,350
722E		7.3	2.25	56.3	736	12/02(10)	0.243	305	860	0.62(6)	1,387
884W		6.4	1.53	77.8	796	12/10(11)	0.165	626	2,960	2.19	1,352
672W		8.8	1.16	85.9	776	12/03(12)	0.231	814	2,000	1.99	1,005
679W		9.0	1.65	114	778	12/03(13)	0.231	1,456	3,500	2.70	1,296
799E	11/09	6.8	1.29	74.5	806	12/10(13)	0.220	907	3,040	2.57	1,183
790E	(08)	7.3	2.67	58.2	805	12/10(13)	0.220	608	1,895	1.80	1,053
486E		6.4	1.03	64.6	761	12/02(15)	0.323	645	1,543	1.96	787
602W		7.5	3.61(6)	55.2	762	12/02(15)	0.323	614	1,268	1.61	788
893W		6.3	1.09	64.9	812	12/10(14)	0.220	853	3,080	2.15	1,433
798W		9.3	2.12	107	807	12/10(13)	0.220	1,144	2,800	2.63	1,065
899E	11/17	6.9	1.31	79.4	818	12/12(15)	0.293	1,414	3,500	2.55	1,373
713E	(08)	5.5	1.18	56.3	821	12/12(16)	0.293	976	3,030	1.87	1,620
880E		7.1	1.37	104	1019	01/01(02)	0.114	269	1,662	3.21	518
886W		14.7	2.49	154	1018	01/01(01)	0.115	851	2,520	2.05	1,229
622W		10.6	2.23	108	815	12/10(14)	0.324	3,042	2,970	2.00	1,485
698W		9.0	1.73	110	1020	01/01(04)	0.114	573	2,790	2.55	1,094

A.1-1 cont'd
P-32 Uptake and Depuration in Bluegill
Viscera

		Weight,				P-32					
Fish No.	Date of death, 1982 (hr)	wet	dry	ashed	Sample No.	Date of counting, 1982 (hr)	decay fraction	net c/min	c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg.
782E	11/20	8.7	1.62	95.6	947	12/22(13)	0.210	639	1,749	2.58	678
767E	(08)	8.6	2.08	92.3	882	12/16(22)	0.275	668	1,412	2.19	645
728E		8.1	1.74	73.5	948	12/22(13)	0.210	629	1,849	2.35	786
715W		8.4	1.94	87.9	1022	01/01(09)	0.131	391	1,777	2.32	766
889W		8.1	1.88	101.5	954	12/22(14)	0.209	578	1,707	2.87	595
606W		8.7	2.30	81.8	953	12/22(14)	0.209	665	1,829	2.16	847
477E	11/24	7.8	2.04	83.7	1031	01/01(24)	0.153	284	1,190	2.34	509
738E	(08)	6.0	1.16	74.6	1041	01/07(11)	0.118	172	1,215	2.43	500
691E		9.6	2.03	107.5	1040	01/07(11)	0.118	283	1,249	2.61	479
668W		9.1	1.78	97.0	943	12/22(13)	0.255	641	1,381	2.59	533
717W		5.8	1.30	70.8	942	12/22(12)	0.255	548	1,853	3.04	610
891W		8.1	1.68	94.5	1032	01/02(02)	0.153	362	1,461	2.68	545
637E	11/30	8.7	1.58	89.5	962	12/22(16)	0.339	397	673	2.55	264
721E	(08)	5.1	0.90	61.4	892	12/16(06)	0.461	285	605	3.00	202
723E		6.1	1.17	70.6	890	12/16(23)	0.469	400	735	3.02	243
892W		16.2	4.19	179.1	964	12/23(10)	0.326	896	847	2.77	306
885W		5.3	1.89	46.5	961	12/22(15)	0.339	243	677	2.03	333
636W		12.4	2.24	125	963	12/23(09)	0.326	607	750	2.34	321
730E	12/07	5.0	1.21	56.5	910	12/18(21)	0.573	272	475	2.66	179
871E	(08)	6.7	1.63	78.0	984	12/25(01)	0.424	151	266	2.52	106
705E		9.1	1.51	107.0	981	12/24(22)	0.426	205	264	2.37	111
641W		5.7	1.39	63.8	982	12/23(13)	0.456	234	450	2.84	158
615W		8.6	1.36	88.0	972	12/23(11)	0.458	373	473	2.77	171
735W		5.2	1.22	49.7	983	12/24(24)	0.424	192	435	2.31	188
694E	12/15	12.0	1.64	144.0	997	12/30(15)	0.476	162	142	2.23	63.7
485E	(08)	11.3	1.93	135.0	999	12/30(18)	0.474	183	171	2.37	72.2
894E		13.8	2.84	187.0	1024	01/01(12)	0.435	180	150	2.69	55.8
692W		13.9	2.96	148.0	1080	01/07(15)	0.323	190	211	2.37	89.0
854W		9.6	3.02	94.5	1023	01/01(10)	0.437	158	188	2.08	90.4
630W		7.6	2.66	69.4	989	12/30(02)	0.489	112	151	2.13	70.9

A.1-1 cont'd
P-23 Uptake and Depuration in Bluegill
Scales and Skin

						P-32					
Fish No.(1)	Date of death, 1982 (hr)	Weight, wet	dry	ashed	Sample No.	Date of counting, 1982 (hr)	decay fraction	net c/min.	c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg.
761E	09/28	15.2	5.39	2,160	309	10/14(04)	0.465	113	79.9	35.3	2.26
794E	(08)	14.6	6.82	3,570	319	10/15(02)	0.443	37.6	29.1	61.2	0.48
879E		18.1	7.02	2,800	321	10/15(04)	0.443	32.4	20.2	40.7	0.50
499W		18.0	7.21	3,020	322	10/14(11)	0.456	215	131	40.4	3.24
708W		12.7	5.91	2,840	370	10/19(20)	0.353	134	149	49.8	2.99
787W		19.2	8.14	3,280	318	10/14(11)	0.456	340	194	38.3	5.07
684E	09/29	19.8	7.68	3,150	388	10/25(12)	0.281	150	135	37.6	3.59
859E	(08)	17.1	7.00	3,600	396	10/25(14)	0.281	283	294	43.8	6.71
863E		12.1	4.25	983(6)	481	11/04(03)	0.176	79.6	187	20.9	8.95
608W		14.6	6.00	1,960	474	11/04(13)	0.173	146	289	33.4	8.65
682W		18.1	6.45	2,090	399	10/25(15)	0.279	352	349	32.1	10.9
890W		16.3	6.44	2,610	608	11/16(20)	0.094	148	483	33.3	14.5
619E	09/30	12.6	4.85	1,720	501	11/05(17)	0.171	29.1	67.5	31.2	2.16
872E	(08)	20.3	8.39	3,330	389	10/25(12)	0.295	356	297	37.0	8.03
635E		16.6	7.34	3,010	414	10/25(18)	0.292	411	424	44.5	9.53
706W		17.2	7.03	2,800	411	10/25(18)	0.292	328	327	37.0	8.63
704W		14.0	5.38	1,660	401	10/25(15)	0.293	235	286	29.4	9.73
480W		18.3	7.85	3,250	432	10/25(24)	0.288	348	330	37.2	8.87
759E	10/06	12.0	6.07	2,680	568	11/09(12)	0.191	248	541	57.5	9.41
674E	(08)	10.6	4.30	1,650	595	11/10(11)	0.182	365	946	28.0	33.8
762E		10.3	5.10	2,150	492	11/04(16)	0.241	373	751	43.9	17.1
613W		8.0	3.66	1,270	583	11/09(14)	0.190	445	1,464	28.3	51.7
680W		8.0	3.11	838	531	11/06(16)	0.219	442	1,261	22.5	56.0
792W		8.8	3.87	1,270	569	11/09(12)	0.191	384	1,142	37.6	30.4
699E	10/12	16.7	8.21	3,810	546	11/07(18)	0.278	1,032	1,111	42.9	25.9
784E	(08)	14.1	6.23	2,970	502	11/04(19)	0.320	1,244	1,379	49.5	27.9
733E		12.8	5.29	1,940	570	11/09(13)	0.255	256	392	42.2	9.29
488W		11.4	4.76	1,520	522	11/04(22)	0.319	1,181	1,624	30.0	54.1
490W		9.5	3.79	1,440	565	11/09(11)	0.256	536	1,102	25.5	43.2
476W		15.8	8.06	3,620	539	11/07(06)	0.285	934	1,037	54.7	19.0

A.1-1 cont'd
P-32 Uptake and Depuration in Bluegill
Scales and Skin

Fish No.	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32: Date of counting, 1982 (hr)	P-32: decay fraction	P-32: net c/min	P-32: c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg.
769E	10/19	9.0	4.17	1,510	630	11/17(16)	0.254	690	1,509	31.5	47.9
482E	(08)	7.6	3.48	1,090	652	11/23(11)	0.182	326	1,178	37.1	31.8
677E		16.1	6.57	2,960	649	11/18(15)	0.230	434	586	43.7	13.4
497W		6.6	3.03	1,050	633	11/18(11)	0.232	648	2,120	35.7	59.4
873W		13.9	6.28	2,560	653	11/23(11)	0.182	1,088	2,150	44.4	48.4
607W		16.9	7.74	3,110	657	11/23(12)	0.182	881	1,432	41.4	34.6
876E	10/26	8.0	3.96	1,540	802	12/10(12)	0.112	393	2,190	41.2	53.2
763E	(08)	16.0	7.23	3,220	680	11/23(15)	0.254	1,102	1,356	47.0	28.9
881E		7.5	3.33	1,130	679	11/23(15)	0.254	246	646	36.6	17.7
785W		14.7	6.63	2,680	681	11/23(16)	0.254	1,080	1,446	42.3	27.6
716W		15.5	7.76	3,400	689	11/24(14)	0.243	1,137	1,509	53.0	28.5
875W		16.6	7.43	3,020	684	11/24(13)	0.243	1,226	1,520	39.0	39.0
882E	11/03	13.8	5.64	2,420	723	11/26(07)	0.328	996	1,100	43.6	25.2
456E	(08)	8.8	3.40	940	720	11/26(02)	0.331	803	1,378	30.7	44.9
627E		17.8	7.56	3,390	746	12/02(11)	0.244	1,321	1,521	41.2	36.9
858E		18.5	6.95	2,290	791	12/10(10)	0.166	729	1,187	30.2	39.3
722E		9.6	4.23	1,350	774	12/03(12)	0.231	636	1,434	36.4	39.4
884W		11.0	4.78	1,810	789	12/10(09)	0.166	651	1,783	41.5	43.0
672W		12.5	5.94	2,820	722	11/26(06)	0.329	621	765	49.5	15.5
679W		17.4	8.28	3,770	677	11/23(14)	0.374	1,943	1,493	46.0	32.5
799E	11/09	12.1	5.22	2,180	728	11/26(14)	0.434	1,548	1,474	41.6	35.4
790E	(08)	10.7	5.03	1,650	726	11/26(11)	0.436	1,590	1,705	39.6	43.1
486E		15.9	7.16	3,100	734	11/27(01)	0.423	921	684	45.3	15.1
602W		12.2	5.62	1,800	729	11/26(16)	0.431	1,100	1,046	37.9	27.6
893W		13.1	6.57	3,190	758	12/02(14)	0.324	1,112	1,308	51.8	25.3
798W		15.6	7.24	3 060	732	11/26(21)	0.427	2,605	1,955	39.2	49.9
899E	11/17	11.7	5.31	2,310	825	12/10(22)	0.319	1,154	1,546	44.5	34.7
713E	(08)	8.1	3.37	990	819	12/10(15)	0.323	960	1,835	29.3	62.6
880E		13.1	5.55	2,440	829	12/11(18)	0.306	717	894	41.9	21.3
886W		16.5	6.82	3,110	831	12/11(21)	0.305	2,529	1,631	46.1	35.4
622W		11.0	4.40	1,670	823	12/10(19)	0.320	1,696	2,410	41.3	58.4
698W		14.3	6.35	2,930	827	12/11(02)	0.315	1,390	1,543	46.7	33.0

A.1-1 cont'd
P-32 Uptake and Depuration in Bluegill
Scales and Skin

Fish No.	Date of death, 1982 (hr)	Weight, wet	dry	ashed	Sample No.	P-32: Date of counting, 1982 (hr)	decay fraction	net c/min	c/min.g. wet	p, mg/g wet	P-32/P, c/min.mg.
782E	11/20	16.8	6.69	2,850	861	12/16(14)	0.280	1,051	1,117	45.1	24.8
767E	(08)	15.9	6.53	2,070	1011	12/31(14)	0.135	533	1,242	31.7	39.2
728E		15.9	7.18	3,280	950	12/22(14)	0.209	1,254	1,887	45.8	41.2
715W		14.2	6.45	2,760	830	12/11(19)	0.353	1,400	1,396	43.3	32.2
889W		21.1	9.08	3,920	833	12/11(24)	0.350	2,783	1,884	45.9	41.0
606W		23.4	9.05	3,080	860	12/16(14)	0.280	2,105	1,606	37.2	43.2
477E	11/24	15.8	6.77	2,680	1037	01/02(10)	0.150	474	1,000	37.3	26.8
738E	(08)	9.8	4.65	2,070	925	12/22(09)	0.257	565	1,122	50.1	22.4
691E		13.5	6.14	2,620	1033	01/02(03)	0.152	551	1,343	44.2	30.0
668W		18.2	7.86	3,300	865	12/16(15)	0.339	1,346	1,091	42.2	25.9
717W		14.4	5.80	2,250	879	12/16(21)	0.336	1,480	1,529	40.8	37.5
891W		15.0	6.65	2,800	1036	01/02(08)	0.151	525	1,159	41.7	27.8
637E	11/30	15.2	6.50	2,480	935	12/22(11)	0.342	757	729	39.2	18.6
721E	(08)	12.8	6.02	2,690	863	12/16(15)	0.453	600	517	50.0	10.3
723E		14.0	6.29	2,510	906	12/18(16)	0.411	793	689	45.8	15.0
892W		18.4	8.86	3,900	859	12/16(13)	0.456	2,813	1,677	57.3	29.3
885W		12.0(6)	3.33	1,080	905	12/18(14)	0.412	1,249	1,263	23.9(6)	52.8
636W		13.2	6.60	2,820	934	12/22(11)	0.342	1,084	1,202	52.6	22.9
730E	12/07	12.2	4.83	2,000	893	12/17(18)	0.603	1,014	689	43.0	16.0
871E	(08)	13.4	4.55	1,660	899	12/18(14)	0.592	486	306	33.0	9.27
705E		16.3	7.50	3,680	921	12/19(17)	0.548	506	283	61.2	4.62
641W		8.0	3.08	1,130	902	12/18(10)	0.584	778	833	39.3	21.2
615W		12.0	5.26	2,550	894	12/17(20)	0.601	775	537	56.0	9.59
735W		8.9	3.03	890	903	12/18(11)	0.584	884	850	30.4	28.0
694E	12/15	15.2	6.50	3,280	994	12/30(10)	0.481	442	302	48.6	6.21
485E	(08)	20.5	8.53	3,790	1010	12/31(13)	0.456	665	356	46.5	7.66
894E		18.1	7.19	2,980	995	12/30(12)	0.479	573	330	39.0	8.46
692W		19.4	7.85	3,140	1009	12/31(11)	0.458	895	504	38.0	13.3
854W		15.9	6.13	2,040	996	12/30(14)	0.477	774	510	29.9	17.0
630W		12.6	4.48	1,400	1027	01/01(17)	0.431	406	374	27.9	13.4

A.1-1 cont'd
P-32 Uptake and Depuration in Bluegill
Gills

Fish No.(1)	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32: Date of counting, 1982 (hr)	P-32: decay fraction	P-32: net c/min.	P-32: c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg.
761E	09/28	0.64	0.096	7.7	296	10/13(06)	0.486	8.4	135	3.93	34.4
794E	(08)	1.06	0.161	18.5	300	10/13(23)	0.469	<2.2	<22	3.79	< 6
879E		0.76	0.138	10.0	339	10/19(18)	0.354	<2.2	<41	3.00	<14
499W		0.91	0.133	9.3	289	10/12(23)	0.493	48.1	536	2.00	268
708W		0.49	0.081	9.3	313	10/14(19)	0.449	12.7	289	2.38	121
787W		0.68	0.121	16.1	302	10/14(00)	0.469	44.6	699	3.17	221
684E	09/29	0.73	0.102	9.5	376	10/21(01)	0.348	13.6	268	2.49	108
859E	(08)	0.74	0.104	11.5	378	10/21(03)	0.348	37.3	724	2.22	326
863E		0.37	0.066	3.8	476	11/03(20)	0.179	3.4	257	2.84	90.5
608W		0.73	0.107	6.5	603	11/11(03)	0.126	13.1	712	1.92	371
682W		0.71	0.117	6.0	367	10/19(19)	0.370	35.5	676	2.08	325
890W		0.71	0.097	5.3	477	11/03(21)	0.179	17.2	677	1.73	391
619E	09/30	0.51	0.169	10.5	412	10/22(17)	0.338	<2.2	<64	2.29	<28
872E	(08)	1.11	0.157	16.9	373	10/21(00)	0.367	58.7	720	2.33	309
635E		0.74	---	6.7	366	10/19(17)	0.390	47.6	825	2.32	356
706W		1.11	0.177	6.4	379	10/21(18)	0.354	56.2	715	2.09	342
704W		0.80	0.119	10.0	402	10/22(09)	0.344	44.9	816	2.70	302
480W		1.05	0.153	10.0	384	10/21(23)	0.351	70.5	956	2.60	368
759E	10/06	0.44	0.073	3.7	575	11/09(22)	0.187	16.8	1,021	2.45	417
674E	(08)	0.36	0.068	4.6	456	11/02(23)	0.262	37.2	1,972	2.83	697
762E		0.63	0.110	7.2	508	11/05(20)	0.228	52.2	1,817	2.63	691
613W		0.52	0.088	6.0	574	11/09(20)	0.188	36.2	1,851	3.01	615
680W		0.55	0.087	4.7	464	11/03(04)	0.260	55.6	1,944	2.28	853
792W		0.58	0.102	6.4	470	11/03(18)	0.252	51.8	1,772	2.34	757
699E	10/12	0.97	0.114	8.0	578	11/10(01)	0.249	84.4	1,747	1.83	955
784E	(08)	0.79	0.120	12.5	550	11/07(24)	0.274	98.8	2,280	2.64	864
733E		0.78	0.087	5.2	576	11/09(23)	0.250	24.6	631	1.80	351
488W		0.69	0.102	5.4	581	11/10(04)	0.247	80.6	2,360	45.7 (6)	---
490W		0.48	0.070	5.2	551	11/08(02)	0.274	44.9	1,707	2.28	749
476W		0.76	0.102	7.2	573	11/09(18)	0.252	41.4	1,081	2.18	496

A.1-1 cont'd
P-32 Uptake and Depuration in Bluegill
Gills

Fish No.	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32: Date of counting, 1982 (hr)	P-32: decay fraction	P-32: net c/min	P-32: c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg.
769E	10/19	0.48	0.058	---	604	11/11(04)	0.315	58.0	1,918	2.10	913
482E	(08)	0.46	0.080	6.7	588	11/10(17)	0.338	46.7	1,501	2.51	598
677E		0.77	0.105	9.0	558	11/08(10)	0.378	68.2	1,172	1.67	702
497W		0.44	0.078	5.7	590	11/10(20)	0.335	68.9	2,340	2.52	929
873W		0.67	0.101	8.3	591	11/10(22)	0.335	119	2,650	2.30	1,152
607W		1.18	0.163	13.8	557	11/08(09)	0.378	192	2,150	1.64	1,311
876E	10/26	0.37	0.074	6.7	696	11/24(08)	0.245	32.0	1,765	2.80	630
763E	(08)	0.71	0.135	10.9	694	11/24(04)	0.248	70.4	1,999	2.83	706
881E		0.26	0.059	6.9(6)	693	11/24(03)	0.248	11.2	868	4.16	210
785W		0.88	0.118	7.3	711	11/25(11)	0.232	53.7	1,315	1.46	901
716W		0.65	0.127	12.5	741	12/01(20)	0.170	48.2	2,180	3.76	580
875W		0.60	0.161	66.4(6)	697	11/24(09)	0.245	55.3	1,881	1.92	980
882E	11/03	0.71	0.089	5.0	704	11/24(23)	0.351	67.9	1,362	1.54	884
456E	(08)	0.40	0.066	3.2	706	11/25(03)	0.351	40.9	1,457	2.44	597
627E		1.04	0.132	11.2	803	12/10(02)	0.168	65.2	1,866	1.67	1,117
858E		0.76	0.123	8.1	738	12/01(15)	0.254	55.6	1,440	2.40	600
722E		0.65	0.096	5.4	740	12/01(18)	0.252	44.4	1,355	2.55	531
884W		0.42	0.077	8.5	739	12/01(16)	0.254	33.4	1,565	3.35	467
672W		0.67	0.071	5.5	794	12/09(18)	0.170	20.2	887	1.26	704
679W		0.87	0.120	11.6	797	12/09(19)	0.170	44.1	1,488	1.62	919
799E	11/09	0.47	0.073	7.2	781	12/02(19)	0.320	45.2	1,504	1.89	796
790E	(08)	0.75	0.114	5.9	783	12/02(22)	0.318	77.8	1,631	2.07	788
486E		0.65	0.096	4.6	782	12/02(21)	0.318	55.0	1,332	2.12	628
602W		0.76	0.091	7.5	750	12/02(01)	0.332	54.8	1,086	1.66	654
893W		0.88	0.120	9.4	737	12/01(13)	0.341	104.	1,735	2.14	811
798W		0.76	0.092	5.9	784	12/02(24)	0.317	64.0	1,329	1.58	841
899E	11/17	0.56	0.091	6.0	756	12/02(08)	0.483	128.	2,370	2.09	1,134
713E	(08)	0.45	0.061	6.5	753	12/02(04)	0.486	72.1	1,648	2.80	589
880E		0.64	0.096	7.4	754	12/02(06)	0.486	106.	1,704	2.00	852
886W		0.67	0.103	9.0	755	12/02(13)	0.479	133.	2,070	1.72	1,203
622W		0.63	0.103	9.2	813	12/11(07)	0.312	83.4	2,120	2.47	858
698W		1.18	0.145	12.7	1021	01/01(07)	0.113	41.6	1,560	1.53	1,020

A.1-1 cont'd
P-32 Uptake and Depuration in Bluegill
Gills

Fish No.	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32: Date of counting, 1982 (hr)	P-32: decay fraction	P-32: net c/min	P-32: c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg.
782E	11/20	0.84	0.116	9.8	883	12/15(18)	0.291	65.1	1,332	2.15	620
767E	(08)	0.75	0.118	11.4	884	12/15(20)	0.291	52.3	1,198	3.08	389
728E		0.75	0.105	--	946	12/23(18)	0.198	54.4	1,832	2.25	814
715W		0.76	0.108	3.7	949	12/23(19)	0.197	44.2	1,476	2.04	724
889W		1.00	0.146	10.9	951	12/23(21)	0.197	61.4	1,558	2.15	725
606W		1.18	0.173	5.7	952	12/23(22)	0.196	87.6	1,894	2.21	857
477E	11/24	0.50	0.080	2.4	888	12/16(01)	0.349	41.0	1,175	2.55	461
738E	(08)	0.88	0.142	11.4	960	12/24(05)	0.235	55.4	1,339	2.61	513
691E		0.72	0.112	9.7	889	12/16(02)	0.349	71.7	1,427	3.04	469
668W		0.81	0.119	8.4	959	12/24(04)	0.236	48.4	1,266	2.05	618
717W		0.50	0.090	6.1	937	12/22(01)	0.261	46.1	1,766	2.69	657
891W		1.00	0.146	11.0	938	12/22(03)	0.260	66.9	1,287	2.44	527
637E	11/30	0.79	0.101	8.2	887	12/15(23)	0.469	52.6	709	1.95	364
721E	(08)	0.76	0.091	7.0	1039	01/07(18)	0.156	9.9	417	1.87	223
723E		0.56	0.071	5.8	891	12/16(04)	0.464	26.8	515	1.90	271
892W		1.65	0.221	19.9	1038	01/02(12)	0.200	55.7	845	2.08	406
885W		0.47	0.066	6.2	1034	01/02(05)	0.203	13.0	682	2.05	333
636W		0.90(6)	0.072	4.5	886	12/15(22)	0.470	30.0	355	1.02(6)	348
730E	12/07	0.61	0.102	9.0	1003	12/31(01)	0.317	24.5	634	2.68	237
871E	(08)	0.52	0.084	3.6	1005	12/31(04)	0.315	12.4	379	3.05	124
705E		1.13	0.162	9.8	1001	12/30(22)	0.319	30.4	422	2.85	148
641W		0.75	0.102	8.8	904	12/18(13)	0.581	40.9	469	3.53	133
615W		0.80	0.098	5.3	911	12/18(24)	0.568	46.9	516	2.16	239
735W		0.53	0.070	4.1	1004	12/31(03)	0.315	17.1	512	2.26	227
694E	12/15	1.04	0.151	10.5	1054	01/11(12)	0.268	12.6	226	2.52	89.7
485E	(08)	0.94	0.134	1.2(6)	1101	01/14(07)	0.234	15.2	346	2.52	137
894E		1.53	0.250	12.4	1098	01/14(02)	0.236	23.4	324	2.28	142
692W		1.69	0.306	---	1096	01/13(22)	0.238	43.8	544	5.11(6)	106
854W		0.78	0.151	7.9	990	12/30(04)	0.487	23.9	315	2.85	111
630W		0.76	0.142	9.7	1081	01/12(19)	0.252	10.5	274	3.25	84.3

A.1-1 cont'd
P-32 Uptake and Depuration in Bluegill
Head

Fish No.(1)	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32 Date of counting, 1982 (hr)	P-32 decay fraction	P-32 net c/min.	P-32 c/min.g. wet	P, mg g/wet	P-32/P, c/min.mg.
761E	09/28	35.9	9.16	3,530	385	10/22(01)	0.317	123	54.0	22.3	2.42
794E	(08)	41.2	11.26	4,890	312	10/14(18)	0.452	42.4	11.4	25.2	0.45
879E		50.3	14.24	4,660	333	10/15(09)	0.439	42.6	9.6	17.6	0.55
499W		46.1	12.39	5,000	323	10/14(12)	0.456	559	133	21.3	6.24
708W		34.3	9.91	3,610	324	10/14(12)	0.456	347	111	18.9	5.87
787W		42.6	11.40	3,970	394	10/25(14)	0.268	433	190	18.7	10.2
684E	09/29	47.3	13.13	4,520	489	11/04(15)	0.172	181	111	19.8	5.61
859E	(08)	43.2	11.86	4,470	446	11/03(12)	0.188	335	206	23.3	8.84
863E		28.5	8.32	1,980	533	11/06(20)	0.162	140	152	15.3	9.93
608W		29.6	9.02	2,640	472	11/04(12)	0.173	291	284	19.9	14.3
682W		34.1	13.86	3,340	445	11/03(12)	0.188	408	318	20.7	15.4
890W		40.2	10.28	3,790	359	10/21(11)	0.343	904	328	18.7	17.5
619E	09/30	32.7	---	---	395	10/22(06)	0.346	77.4	34.2	19.3	1.77
872E	(08)	46.2	13.05	4,310	390	10/25(12)	0.295	611	229	19.1	12.0
635E		38.6	10.95	---	391	10/25(13)	0.295	658	289	19.2	15.1
706W		28.5	7.12	2,590	520	11/06(08)	0.166	222	235	18.9	12.4
		14.0	4.13	434(6)	478	11/03(23)	0.187	149	285	19.3	14.8
704W		33.9	10.35	2,750	392	10/25(13)	0.295	618	309	19.1	16.2
480W		44.8	13.78	4,330	497	11/04(17)	0.180	424	263	21.2	12.4
759E	10/06	31.2	9.14	3,400	498	11/04(18)	0.240	569	380	25.9	14.7
674E	(08)	33.0	9.34	3,270	500	11/04(18)	0.240	892	563	23.4	24.1
762E		33.6	9.59	2,800	493	11/04(16)	0.241	872	538	22.7	23.7
613W		26.0	7.69	2,100	593	11/09(16)	0.189	754	767	15.9	48.2
680W		25.7	7.28	1,780	609	11/17(11)	0.129	694	1,047	13.9	75.3
792W		31.2	10.64	2,330	585	11/09(15)	0.190	954	805	14.8	54.4
699E	10/12	48.5	12.96	4,980	526	11/04(23)	0.319	1,563	505	25.5	19.8
784E	(08)	48.0	12.89	4,230	547	11/07(19)	0.277	2,543	956	18.9	50.6
733E		40.8	10.39	4,320	563	11/09(11)	0.256	684	327	20.6	15.9
488W		37.0	10.81	2,600	540	11/07(08)	0.284	2,686	1,298	16.5	78.7
490W		32.0	9.07	2,800	560	11/09(10)	0.256	1,626	992	18.7	53.0
476W		58.3	16.17	5,510	525	11/04(23)	0.319	1,488	400	22.6	17.7

A.1-1 cont'd
P-32 Uptake and Depuration in Bluegill
Head

Fish No.	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32: Date of counting, 1982 (hr)	P-32: decay fraction	P-32: net c/min	P-32: c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg.
769E	10/19	28.1	9.0	2,410	643	11/18(13)	0.231	1,154	889	15.7	56.6
482E	(08)	27.5	8.8	2,150	650	11/18(15)	0.230	1,006	795	17.1	46.5
677E		36.7	10.0	4,280	634	11/18(11)	0.232	690	405	24.5	16.5
497W		26.7	8.1	1,990	635	11/18(12)	0.231	1,504	1,219	17.5	69.7
873W		48.8	13.8	3,970	648	11/18(14)	0.231	2,995	1,328	16.8	79.0
607W		53.8	15.9	4,880	636	11/22(08)	0.192	1,634	791	15.6	51.0
876E	10/26	31.4	9.4	2,660	686	11/24(13)	0.243	1,595	1,045	20.8	50.2
763E	(08)	47.0	13.7	5,210	690	11/24(15)	0.242	1,697	746	25.0	29.8
881E		24.8	7.5	2,120	644	11/18(04)	0.331	501	305	17.3	17.6
785W		42.6	12.7	4,280	801	12/10(12)	0.112	813	852	19.7	43.2
716W		42.3	12.7	4,230	682	11/23(16)	0.254	2,016	938	21.7	43.2
875W		50.2	15.3	4,670	645	11/18(13)	0.325	2,347	725	19.1	38.0
882E	11/03	40.7	11.0	3,990	742	12/02(11)	0.243	1,504	760	20.1	37.8
456E	(08)	27.0	8.1	1,970	772	12/03(11)	0.232	1,401	1,118	15.1	74.0
627E		51.0	14.3	5,070	691	11/24(15)	0.356	3,620	997	20.4	48.9
858E		45.7	13.9	3,590	672	11/23(13)	0.376	2,497	726	16.2	44.8
722E		39.2	12.1	2,660	748	12/02(12)	0.243	1,518	797	14.2	56.1
884W		33.7	10.3	2,790	721	11/26(04)	0.331	2,251	1,009	18.9	53.4
672W		41.5	10.7	4,230	792	12/10(10)	0.166	622	453	22.8	19.9
679W		50.9	13.7	5,150	676	11/23(14)	0.375	3,066	803	21.7	37.0
799E	11/09	43.9	11.8	3,940	727	11/26(13)	0.434	2,753	723	18.8	38.5
790E	(08)	39.4	12.6	2,900	725	11/26(10)	0.436	3,591	1,046	28.5	36.7
486E		50.5	13.9	5,300	760	12/02(14)	0.323	1,091	329	24.3	13.5
602W		40.0	12.9	3,020	735	11/27(02)	0.422	2,359	700	27.4	25.5
893W		45.1	13.4	---	764	12/02(16)	0.323	2,035	700	23.1	30.3
798W		54.8	16.3	4,500	769	12/03(10)	0.310	2,650	780	15.3	51.1
899E	11/17	41.7	11.1	3,980	820	12/10(16)	0.323	2,544	944	20.5	46.0
713E	(08)	28.2	8.0	1,940	837	12/12(07)	0.298	2,382	1,417	13.6	104.
880E		38.4	10.3	3,660	838	12/12(08)	0.298	1,272	556	20.8	26.7
886W		61.1	17.1	5,450	909	12/18(21)	0.217	3,444	1,299	16.8	77.3
622W		42.9	12.3	3,350	908	12/18(20)	0.217	2,075	1,114	19.3	57.7
698W		47.1	12.2	4,050	836	12/12(05)	0.299	2,762	981	17.4	56.4

A.1-1 cont'd
P-32 Uptake and Depuration in Bluegill
Head

Fish No.	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32 Date of counting, 1982 (hr)	P-32 decay fraction	P-32 net c/min	P-32 c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg.
782E	11/20	56.0	14.3	4,440	933	12/22(11)	0.211	1,444	611	16.0	38.2
767E	(08)	55.2	15.4	4,190	1014	12/31(20)	0.133	934	636	15.8	40.3
728E		48.7	14.5	4,460	843	12/12(17)	0.338	3,507	940	19.1	49.2
715W		53.3	16.9	4,550	872	12/16(19)	0.277	2,057	697	19.0	36.7
889W		47.1	13.7	4,220	1015	12/31(21)	0.133	1,203	960	20.0	48.0
606W		61.2	18.2	5,200	1012	12/31(16)	0.135	1,175	711	18.0	39.5
477E	11/24	46.9	14.1	4,160	871	12/16(18)	0.338	1,917	605	20.4	29.7
738E	(08)	38.1	10.6	3,820	870	12/16(18)	0.338	1,449	563	19.4	29.0
691E		51.5	14.8	4,380	850	12/16(10)	0.343	2,448	693	18.4	37.7
668W		54.5	15.0	5,290	839	12/12(10)	0.416	2,793	616	20.8	29.6
717W		41.7	12.3	4,030	840	12/12(12)	0.414	3,427	993	21.8	45.6
891W		43.9	12.3	3,790	842	12/12(15)	0.412	2,439	674	22.8	29.6
637E	11/30	48.9	13.4	3,910	841	12/12(14)	0.554	2,451	452	16.9	26.7
721E	(08)	36.9	10.3	3,810	869	12/16(18)	0.451	839	252	26.4	9.54
723E		42.9	12.2	3,970	873	12/16(19)	0.451	1,385	358	20.2	17.7
892W		74.4	22.4	6,370	874	12/16(19)	0.451	4,551	678	18.6	36.5
885W		42.5	12.4	2,490	854	12/16(12)	0.453	3,849	999	14.0	67.0
636W		54.6	15.4	4,720	844	12/12(18)	0.547	2,911	488	3.15(6)	----
730E	12/07	37.4	10.9	3,130	918	01/14(14)	0.157	545	464	16.4	28.3
871E	(08)	40.0	11.7	3,180	1007	12/31(08)	0.312	558	224	15.2	14.7
705E		53.3	14.9	---	1060	01/07(14)	0.219	378	162	22.4	7.23
641W		31.1	9.2	2,250	988	12/23(14)	0.455	1,306	461	16.6	27.8
615W		49.5	13.0	4,440	919	12/19(14)	0.552	1,487	272	19.3	14.1
735W		32.2	9.5	2,180	916	12/19(09)	0.558	2,064	574	16.2	35.4
694E	12/15	48.5	12.9	5,290	1045	01/07(12)	0.325	423	134	22.1	6.06
485E	(08)	55.1	15.6	5,650	1028	01/01(19)	0.428	623	132	22.9	5.76
894E		53.6	15.4	4,460	1058	01/07(13)	0.325	774	222	18.8	11.8
692W		61.2	18.1	5,130	1029	01/01(20)	0.428	1,100	210	17.7	11.9
854W		45.4	14.1	2,140	1059	01/07(13)	0.325	940	319	15.3	20.8
630W		33.2	10.1	2,140	991	12/30(05)	0.486	910	282	14.1	20.0

A.1-1 cont'd
P-32 Uptake and Depuration in Bluegill
Tail (4)

Fish No.(1)	Date of death, 1982 (hr)	Weight, wet	dry	ashed	Sample No.	P-32: Date of counting, 1982 (hr)	decay fraction	net c/min.	c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg.
761E	09/28	1.19	0.478	240	455	11/02(22)	0.178	9.4	222	34.1	6.51
794E	(08)	1.21	0.517	289	299	10/13(21)	0.472	3.8	33.3	40.0	0.83
879E		1.63	0.635	293	292	10/13(03)	0.488	5.2	32.7	29.7	1.10
499W		1.61	0.714	372	303	10/14(22)	0.447	40.1	279	30.4	9.17
708W		1.31	0.536	261	290	10/13(01)	0.490	25.8	201	35.1	5.73
787W		1.75	0.671	333	297	10/13(19)	0.472	54.6	331	28.0	11.8
684E	09/29	1.39	0.523	266	382	10/21(20)	0.336	23.5	252	33.7	7.48
859E	(08)	1.27	0.488	255	293	10/12(04)	0.538	70.0	512	36.2	14.1
863E		0.65	0.240	107	361	10/20(12)	0.358	18.1	389	31.5	12.3
608W		0.66	0.283	133	607	11/16(18)	0.096	6.4	505	38.2	13.2
682W		1.17	0.407	195	286	10/12(20)	0.520	66.7	548	34.5	15.9
890W		1.31	---	225	365	10/20(15)	0.358	54.1	577	32.0	18.0
619E	09/30	1.27	0.497	223	387	10/22(04)	0.348	7.3	82.6	23.1	3.58
872E	(08)	1.45	0.532	261	362	10/20(14)	0.375	70.5	648	29.7	21.8
635E		1.08	0.436	225	383	10/21(21)	0.353	57.0	748	41.0	18.2
706W		1.17	0.460	233	413	10/25(09)	0.298	28.7	412	39.3	10.5
704W		0.77	0.283	121	407	10/22(12)	0.341	25.8	491	31.6	15.5
480W		1.30	0.570	266	408	10/22(14)	0.341	46.9	529	34.3	15.4
759E	10/06	1.12	0.487	236	552	11/08(04)	0.214	39.0	814	36.3	22.4
674E	(08)	1.08	0.485	231	483	11/04(06)	0.246	62.2	1,171	38.2	30.7
762E		1.08	0.416	192	461	11/03(03)	0.260	94.1	1,676	31.1	53.9
613W		0.81	0.322	147	587	11/10(15)	0.181	65.1	2,220	34.8	63.8
680W		0.78	0.293	117	496	11/05(16)	0.230	71.2	1,984	28.9	68.7
792W		0.95	0.351	149	479	11/04(01)	0.249	80.2	1,699	28.8	59.0
699E	10/12	1.15	0.444	236	514	11/06(02)	0.301	104	1,502	35.1	42.8
784E	(08)	1.60	0.564	290	511	11/04(20)	0.320	178	1,738	28.4	61.2
733E		0.99	0.385	210	538	11/07(04)	0.286	47.2	834	38.1	21.9
488W		1.01	0.354	170	579	11/10(02)	0.250	131	2,590	31.1	83.3
490W		0.90	0.317	160	545	11/07(16)	0.279	96.4	1,920	30.6	62.7
476W		1.41	0.534	275	509	11/05(22)	0.303	122	1,428	35.2	40.6

A.1-1 cont'd
P-32 Uptake and Depuration in Bluegill
Tail (4)

Fish No.(1)	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32 Date of counting, 1982 (hr)	P-32 decay fraction	P-32 net c/min.	P-32 c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg.
769E	10/19	0.84	0.310	132	582	11/10(06)	0.346	133.	2,270	33.5	67.8
482E	(08)	0.60	0.240	117	600	11/10(24)	0.333	83.1	2,070	36.6	56.6
677E		0.88	0.347	173	589	11/10(18)	0.337	73.3	1,236	32.8	37.7
497W		0.76	0.276	122	601	11/11(01)	0.332	124.	2,470	26.7	92.5
873W		1.31	0.462	210	559	11/08(09)	0.379	283.	2,850	33.9	84.1
607W		1.64	0.678	333	599	11/10(12)	0.341	187.	1,672	44.8	37.3

A.1-2
P-32 Uptake in Catfish
Muscle

Fish No.(1)	Date of death, 1982 (hr)	Weight, (2) wet	dry	ashed	Sample No.	P-32 Date of counting, 1982 (hr)	decay fraction	net c/min.(3)	c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg.
351E	08/16	69.1	17.1	955	101*(4)	09/17(13)	0.209	306	212	2.28	93.0
317E	(08)	93.9	--	1,130	17	08/31(17)	0.474	4,240	476	2.17	219.
362E		87.4	18.6	1,170	107	09/17(09)	0.212	199	53.7	2.26	23.8
395W		70.9	16.1	841	47*	09/07(21)	0.336	14.3	6.0	2.30	2.6
418W		66.8	15.4	601	16	08/31(03)	0.488	15.5	2.4	1.70	1.4
409W		105.3	26.3	1,260	15	08/31(02)	0.488	31.0	3.0	2.07	1.5
359E	08/17	78.3	18.5	1,360	22*	09/01(10)	0.481	537	143.	2.18	65.6
357E	(08)	32.9	10.1	498	104	09/17(03)	0.225	42.2	28.5	2.36	12.1
		34.5	9.06	461	109	09/17(17)	0.219	49.2	32.6	2.36	13.8
		33.1	8.72	475	112	09/17(21)	0.218	39.0	27.0	2.25	12.0
300E		47.5	14.1	664	100	09/17(13)	0.220	535	256	2.16	119.
		52.6	13.4	630	159	09/21(14)	0.183	547	284	2.42	117.
421W		95.5	21.3	1,430	23*	08/31(18)	0.493	414	87.9	1.71	51.4
422W		38.9	8.89	430	44	09/03(08)	0.439	18.6	5.4	2.25	2.4
		29.3	7.07	383	108	09/17(16)	0.219	13.8	10.8	2.22	4.9
380W		39.8	9.50	637	24	08/31(18)	0.493	157	40.0	1.85	21.6
		31.3	7.77	420	103	09/16(16)	0.230	85.4	59.3	2.25	26.4
		24.6	6.23	---	76	09/14(17)	0.252	55.0	44.5	2.37	18.8
365E	08/18	70.1	--	773	18	08/31(18)	0.522	1,518	207	3.02	68.5
361E	(08)	119.0	29.1	1,440	128	09/20(16)	0.199	2,627	555	2.48	224.
385E		98.6	24.4	1,110	160	09/21(14)	0.190	1,317	351	2.16	163.
373W		79.9	19.3	1,030	127	09/20(15)	0.199	755	237	2.55	92.9
424W		86.1	21.5	1,020	126	09/20(15)	0.199	321	93.7	2.46	38.1
398W		49.7	10.0	446	195	09/29(07)	0.131	206	158	1.80	87.8
307E	08/24	63.3	16.0	701	123	09/20(14)	0.264	7,137	2,140	2.17	986.
	(08)	35.6	8.78	444	124	09/20(14)	0.264	4,169	2,220	2.20	1,009.
449E		117.8	28.9	1,490	135	09/21(10)	0.256	2,965	492	2.37	208.
276E		70.6	18.4	838	116	09/20(11)	0.269	5,845	1,539	2.72	566.
372W		110.3	30.3	1,260	125	09/20(14)	0.264	1,038	178	2.25	79.1
401W		100.7	19.9	1,180	42	09/02(18)	0.627	10,280	814	2.26	360.
416W		88.7	20.2	1,020	114	09/20(11)	0.269	8,040	1,691	2.18	776.

(1) E fish received twice as much feed as W fish, at same specific activity (2) Wet and dry weight in gram; ashed weight in mg. (3) Duplicate 20-ml aliquots of 100-ml samples were analyzed for P-32 by counting Cherenkov radiation for 50-min. when < 200 c/min and for 10-min. when > 200 c/min. (4) One asterisk indicates a 200-ml solution and two asterisks, 250-ml. (5) Weight appears to be erroneous

A.1-2 cont'd
P-32 Uptake in Catfish
Muscle

Fish No.(1)	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32: Date of counting, 1982 (hr)	P-32: decay fraction	P-32: net c/min.	P-32: c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg.
314E	8/26	45.4	10.9	489	257	10/08(14)	0.123	1,532	1,373	2.05	670
	(08)	54.2	13.3	597	258	10/08(14)	0.123	1,844	1,384	2.07	669
369E		57.7	11.9	641	282	10/11(12)	0.107	2,401	1,950	2.27	859
		47.3	9.89	545	276	10/11(09)	0.107	1,983	1,965	2.59	759
332E		46.2	10.7	536	279	10/11(10)	0.107	1,324	1,343	2.33	576
		43.7	10.5	496	278	10/11(10)	0.107	1,002	1,075	2.16	498
448W		31.5	7.64	383	284	10/12(17)	0.100	189	300	2.39	126
		43.2	10.0	495	275	10/11(09)	0.107	250	271	2.12	128
439W		57.0	12.9	647	280	10/11(11)	0.107	2,333	1,918	2.15	892
		71.0	15.2	784	316	10/14(11)	0.092	2,349	1,790	2.14	836
389W		57.6	14.8	666	281	10/11(11)	0.107	1,741	1,416	2.27	624
		64.2	17.4	705	619	11/17(13)	0.018	347	1,493	2.26	661
355E	9/01	51.4	---	583	261	10/08(15)	0.164	2,242	1,330	2.16	616
	(08)	50.0	---	576	270	10/08(17)	0.164	2,466	1,501	2.31	655
393E		77.0	16.5	903	671	11/23(12)	0.018	334	1,205	2.42	498
348E		33.4	7.68	377	674	11/23(13)	0.018	275	2,290	2.20	1,041
		38.0	9.03	430	752	12/02(13)	0.012	211	2,310	2.12	1,090
414W		47.2	11.0	536	745	12/01(22)	0.012	98.2	867	2.13	407
		59.5	---	676	260	10/08(15)	0.164	1,528	783	2.14	366
403W		49.6	11.1	494	656	11/22(20)	0.018	22.7	127	1.93	65.8
404W		65.9	---	759	271	10/08(17)	0.164	1,809	836	1.10(5)	760
		30.0	6.80	331	675	11/23(14)	0.018	188	1,741	2.48	702
321E	9/10	83.0	17.9	943	267	10/08(16)	0.254	741	176	2.30	76.5
363E	(08)	36.5	8.06	418	197	09/30(15)	0.374	2,083	763	2.24	341
		54.4	12.2	608	225	09/30(22)	0.370	3,142	780	2.14	364
356E		25.7	5.44	313	222	09/30(21)	0.370	202	106	2.34	45.3
387W		91.8	20.0	1,060	266	10/08(16)	0.254	4,263	914	2.48	369
429W		74.8	14.6	865	198	09/30(15)	0.374	2,111	377	2.22	170
431W		79.0	16.4	919	227	09/30(22)	0.370	1,893	324	2.30	141
428W	9/23	129.1	29.2	1,620	291	10/13(09)	0.379	10,950	1,119	2.56	437
410W	(08)	91.0	18.8	1,110	272	10/08(17)	0.474	7,943	921	2.47	373
390W		91.9	20.2	1,080	3	10/13(16)	0.374	1,750	255	2.40	106

A.1-2 cont'd
P-32 Uptake in Catfish
Skeleton

Fish No.	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32: Date of counting, 1982 (hr)	P-32: decay fraction	P-32: net c/min.	P-32: c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg.
351E	08/16	19.0	7.17	1,350	41*	09/03(02)	0.423	303	377	14.9	25.3
317E	(08)	19.1	7.90	1,460	11/12	08/31(15)	0.476	1,296	712	15.8	45.1
362E		19.8	7.44	1,370	117	09/17(20)	0.207	103.2	126	14.7	8.57
395W		22.6	8.66	1,760	7/8	08/30(18)	0.498	7.5	3.3	17.2	0.19
418W		16.7	7.13	1,110	118	09/17(22)	0.206	6.4	9.3	13.0	0.72
409W		21.1	8.79	1,440	28*	09/01(04)	0.465	<2.2	<2.2	13.8	<0.16
359E	08/17	18.4	7.26	1,220	157	09/21(13)	0.182	154	230	13.3	17.3
357E	(08)	18.0	8.09	1,460	158	09/24(07)	0.159	28.7	50.1	17.0	2.95
300E		16.5	7.26	1,300	119	09/20(12)	0.200	215	326	15.5	21.0
421W		17.7	7.86	1,670	106*	09/17(05)	0.225	85.3	214	9.30	23.0
422W		12.2	5.07	926	130	09/22(12)	0.173	<2.2	<5.2	15.1	<0.34
380W		17.5	7.80	1,670	131	09/22(14)	0.173	52.7	87.0	19.7	4.42
365E	08/18	10.4	4.12	732	133	09/21(09)	0.191	209	526	13.3	39.5
361E	(08)	17.7	8.03	1,570	122	09/20(13)	0.200	727	1,027	18.0	57.1
385E		18.1	8.07	1,330	121	09/20(13)	0.200	358	494	14.9	33.2
373W		15.7	6.46	1,200	120	09/20(12)	0.200	195	311	14.3	21.7
424W		12.6	5.74	1,000	132	09/23(12)	0.173	76.9	176	16.2	10.9
398W		7.3	3.03	599	134	09/21(10)	0.191	103.6	372	13.0	28.6
307E	08/24	17.2	6.45	1,250	35	09/02(16)	0.636	8,480	3,880	14.5	268
449E	(08)	22.6	--	---	129	09/21(09)	0.256	707	611	14.3	42.7
276E		14.5	5.88	870	115	09/20(11)	0.269	2,036	2,610	12.0	218
372W		26.4	11.0	1,630	162	09/21(14)	0.254	310	231	11.0	21.0
401W		24.5	9.25	1,680	163	09/21(14)	0.254	1,323	1,063	12.5	85.0
416W		20.7	8.07	1,610	164	09/21(15)	0.254	2,296	2,183	13.9	157

A.1-2 cont'd
P-32 Uptake in Catfish
Skeleton

Fish No.	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32: Date of counting, 1982 (hr)	P-32: decay fraction	P-32: net c/min.	P-32: c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg
314E	8/26	19.2	7.93	1,270	259	10/08(14)	0.123	1,019	2,160	12.4	174
369E	(08)	17.5	6.72	1,400	277	10/11(10)	0.118	1,452	3,520	14.7	239
332E		20.0	7.24	1,400	269	10/08(17)	0.123	583	1,186	11.4	104
448W		13.5	5.45	1,120	263	10/08(16)	0.123	155	467	15.6	29.9
439W		22.2	9.46	1,750	450	11/03(14)	0.035	424	2,710	15.5	175
389W		20.1	8.87	1,480	262	10/08(15)	0.123	912	1,846	15.3	120
355E	9/01	23.6	8.58	1,620	256	10/08(13)	0.165	2,121	2,720		
393E	(08)	----	8.38	1,500	632	11/17(20)	0.023	119	-----		
348E		17.1	5.97	1,000	631	11/17(16)	0.023	248	3,150		
414W		22.4	8.47	1,580	637	11/17(22)	0.023	102	990		
403W		13.0	4.84	971	668	11/23(23)	0.017	3.4	76.9		
404W		19.4	7.41	1,480	714	11/25(16)	0.016	182	2,930		
321E	9/10	24.1	8.16	1,480	228	09/30(22)	0.368	414	233		
363E	(08)	25.5	8.88	1,400	199	09/30(15)	0.374	4,799	2,520		
356E		8.1	2.64	434	245	10/06(24)	0.274	65.8	148		
387W		22.5	7.81	1,420	229	09/30(23)	0.368	3,007	1,816		
429W		22.4	6.80	1,390	254	10/08(13)	0.255	1,216	1,064		
431W		27.7	9.46	1,700	255	10/21(15)	0.135	347	464		
428W	9/23	26.8	9.89	1,840	274	10/11(09)	0.416	7,913	3,550		
410W	(08)	21.8	7.19	1,300	273	10/21(15)	0.254	2,098	1,894		
390W		25.2	9.42	1,700	283	10/11(12)	0.416	902	430		

A.1-2 cont'd
P-32 Uptake in Catfish
Viscera

Fish No.	Date of death, 1982(hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32: Date of counting, 1982 (hr)	P-32: decay fraction	P-32: net c/min.	P-32: c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg.
351E	08/16	13.0	3.91	131	38	09/02(16)	0.298	1,608	2,080	2.05	1,015
317E	(08)	31.0	9.96	450	13	08/31(15)	0.476	8,340	2,820	1.50	1,880
362E		15.5	4.87	---	85	09/15(09)	0.233	214	296	1.44	206
395W		9.8	2.09	---	83	09/14(24)	0.237	<2.2	<4.7	1.57	< 3
418W		15.6	5.43	105	59	09/08(08)	0.328	<2.2	<2.1	1.49	< 2
409W		19.8	7.76	141	55	09/08(02)	0.332	<2.2	<1.7	1.75	< 1
359E	08/17	17.2	7.14	---	78	09/15(08)	0.257	384	434	1.20	362
357E	(08)	21.6	9.13	155	27	08/31(14)	0.501	655	303	1.62	187
300E		18.4	7.65	---	81	09/15(09)	0.257	485	513	1.11	462
421W		17.7	5.14	253	204	09/30(16)	0.117	197	476	1.47	324
422W		11.5	4.34	---	84	09/15(01)	0.249	<2.2	<3.8	1.39	< 3
380W		21.3	8.43	---	77	09/14(19)	0.252	144	134	1.34	100
365E	08/18	12.3	4.73	---	87	09/15(10)	0.256	386	613	1.33	461
361E	(08)	31.8	9.00	339	192	09/30(13)	0.123	2,615	3,340	1.70	1,965
385E		19.6	6.56	191	193	09/30(13)	0.123	1,468	3,040	1.85	1,643
373W		11.8	3.19	121	63	09/10(14)	0.320	1,210	1,602	2.63	609
424W		16.9	7.36	---	79	09/15(09)	0.256	314	363	1.63	223
398W		7.3	2.38	53.2	62	09/10(17)	0.320	243	520	1.45	359
307E	08/24	30.6	9.86	487	185	09/30(12)	0.165	8,526	8,440	2.30	3,670
449E	(08)	21.2	6.75	173	156	09/21(13)	0.255	1,348	1,247	1.36	917
276E		16.1	6.26	153	36	09/02(16)	0.631	9,050	4,450	1.66	2,680
372W		25.3	11.6	183	152	09/21(13)	0.254	1,744	1,357	1.50	905
401W		20.3	4.57	237	75	09/10(16)	0.428	9,263	5,330	1.79	2,980
416W		29.2	9.14	356	153	09/21(13)	0.255	8,818	5,920	1.98	3,020

A.1-2 cont'd
P-32 Uptake in Catfish
Viscera

Fish No.	Date of death, 1982(hr)	Weight, wet	dry	ashed	Sample No.	P-32 Date of counting, 1982 (hr)	decay fraction	net c/min.	c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg.
314E	8/26	40.5	12.9	588	372	10/21(13)	0.066	3,354	6,300	2.88	2,190
369E	(08)	33.7	8.55	316	330	10/15(11)	0.089	2,630	3,660	1.56	2,350
332E		27.5	6.84	425	363	10/21(12)	0.066	2,189	6,060	2.56	2,370
448W		15.5	5.51	116	308	10/13(17)	0.096	206	691	1.39	497
439W		42.7	11.4	616	360	10/21(12)	0.066	2,970	5,290	2.41	2,200
389W		31.7	10.7	391	331	10/15(11)	0.089	2,906	5,170	2.03	2,550
355E	9/01	32.9	10.2	267	744	12/01(22)	0.012	83.0	1,051	1.46	720
393E	(08)	15.2	3.00	158	751	12/02(01)	0.012	55.0	1,508	1.81	833
348E		26.9	9.01	296	716	11/25(20)	0.016	523	6,080	1.94	3,130
414W		23.2	7.75	163	669	11/24(01)	0.017	77.4	981	1.26	779
403W		12.4	3.23	97.2	639	11/17(23)	0.023	8.9	156	1.37	114
404W		24.4	7.23	232	707	11/25(04)	0.016	240	3,070	1.70	1,806
321E	9/10	15.4	3.63	150	251	10/08(12)	0.255	751	956	1.52	
363E	(08)	25.7	6.49	276	344	10/19(12)	0.150	1,374	1,782	1.71	
356E		5.8	1.89	42.5	247	10/07(03)	0.273	50.6	160	1.45	
378W		26.9	7.11	300	252	10/08(12)	0.255	3,154	2,300	1.99	
429W		14.8	3.34	128	236	10/21(15)	0.136	479	1,190	1.42	
431W		17.8	3.53	240	221	09/30(20)	0.370	2,362	1,793	2.04	
428W	9/23	25.1	8.39	211	336	10/19(11)	0.150	2,221	2,950	1.99	
410W	(08)	18.9	6.19	174	357	10/21(11)	0.136	1,029	2,000	1.78	
390W		20.1	5.18	219	337	10/19(11)	0.150	931	1,544	1.91	

A.1-2 cont'd
P-32 Uptake in Catfish
Gills

Fish No.	Date of death, 1982(hr)	Weight, wet	dry	ashed	Sample No.	P-32 Date of counting, 1982 (hr)	decay fraction	net c/min.	c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg
351E	08/16	1.11	0.227	13.3	51	09/07(22)	0.334	33.6	453	2.93	155.
317E	(08)	2.20	0.453	23.0	50	09/08(14)	0.324	171	1,199	4.50(5)	266
362E		2.54	0.510	24.1	94	09/16(07)	0.223	20.8	184	2.59	71.0
395W		2.10	0.548	--	73	09/11(08)	0.285	<2.2	<18	2.21	< 8
418W		1.90	0.322	19.2	90	09/15(16)	0.230	<2.2	<25	2.70	< 9
409W		1.60	0.280	16.8	68	09/11(03)	0.285	4.8	48	2.17	22.1
359E	08/17	2.00	0.386	23.3	88	09/15(03)	0.248	35.2	355	2.88	123.
357E	(08)	1.74	0.359	--	80	09/14(20)	0.251	9.8	112	2.01	55.7
300E		1.90	0.374	16.3	98	09/16(18)	0.228	47.4	547	2.38	230.
421W		1.80	0.345	20.5	21	08/30(07)	0.538	79.7	412	3.26	126.
422W		1.23	0.188	8.2	19	08/30(03)	0.538	<2.2	<17	2.49	< 7
380W		2.50	0.497	23.3	102	09/16(23)	0.228	20.0	175	1.98	88.4
365E	08/18	1.10	0.174	11.7	92	09/15(21)	0.250	41.0	745	2.26	330.
361E	(08)	2.28	0.486	23.9	91	09/17(13)	0.231	118.3	1,123	2.69	417.
385E		1.62	0.362	--	82	09/14(22)	0.263	102.4	1,202	3.26	369
373W		1.10	0.250	15.0	97*	09/16(17)	0.240	22.4	848	3.34	254
424W		1.81	0.379	19.0	93	09/16(03)	0.248	37.0	412	2.39	172
398W		0.53	0.100	5.4	64	09/10(20)	0.320	11.3	333	2.18	153
307E	08/24	2.20	0.439	17.6	111	09/17(13)	0.310	607	4,450	2.13	2,090
449E	(08)	2.11	0.404	25.0	69	09/11(04)	0.422	217	1,219	2.98	409
276E		0.88	0.165	8.9	71	09/11(07)	0.418	208	2,830	2.44	1,160
372W		2.10	0.458	15.4	110	09/17(19)	0.308	61.8	478	2.01	238
401W		2.04	0.284	12.0	96	09/17(13)	0.310	187	1,480	1.72	860
416W		1.95	0.399	23.6	66	09/10(14)	0.437	564	3,310	2.35	1,409

A.1-2 cont'd
P-32 Uptake in Catfish
Gills

Fish No.	Date of death, 1982(hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32: Date of counting, 1982 (hr)	P-32: decay fraction	P-32: net c/min.	P-32: c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg.
314E	8/26	1.28	0.214	16.1	618	11/17(02)	0.018	7.3	1,576	1.48	1,065
369E	(08)	1.40	0.227	10.9	662	11/23(05)	0.013	6.8	1,821	1.32	1,380
332E		1.37	0.202	12.3	482	11/04(05)	0.033	10.2	1,117	1.30	859
448W		0.85	0.145	9.5	661	11/23(03)	0.013	<2.2	<970	1.25	< 800
439W		2.17	0.309	10.7	660	11/23(02)	0.013	8.4	1,451	1.13	1,284
389W		1.40	0.211	9.7	659	11/22(24)	0.013	4.0	1,071	1.29	830
355E	9/01	1.49	0.243	14.0	486	11/05(12)	0.042	32.0	2,560		
393E	(08)	1.65	0.233	15.0	708	11/25(06)	0.016	10.6	2,040		
348E		1.71	0.274	16.2	641	11/18(01)	0.023	26.6	3,380		
414W		2.11	0.395	--	515	11/06(03)	0.041	33.4	1,930		
403W		1.48	0.209	11.6	665	11/23(18)	0.018	<2.2	<410		
404W		2.75	0.354	21.8	798	12/09(21)	0.0081	12.3	2,760		
321E	9/10	2.01	0.325	20.0	224	09/29(24)	0.385	78.5	507		
363E	(08)	2.33	0.407	30.6	238	10/07(14)	0.268	210	1,682		
356E		0.41	0.067	--	358	10/20(10)	0.143	2.1	179		
387W		2.56	0.429	16.4	220	09/30(20)	0.368	383	2,030		
429W		2.32	0.376	22.2	230	09/30(23)	0.368	296	1,734		
431W		2.01	0.306	18.0	241	10/06(23)	0.275	99.0	896		
428W	9/23	3.67	0.557	28.5	347	10/19(12)	0.280	373	1,815		
410W	(08)	3.50	0.509	26.7	356	10/20(09)	0.269	214	1,136		
390W		2.25	0.354	20.3	355	10/20(07)	0.269	86.6	715		

A.1-2 cont'd
P-32 Uptake in Catfish
Skin

Fish No.	Date of death, 1982(hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32: Date of counting, 1982 (hr)	P-32: decay fraction	P-32: net c/min.	P-32: c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg
351E	08/16	9.8	3.38	88.8	49	09/08(14)	0.324	147	231	2.00	116
317E	(08)	13.9	5.02	96.4	37	09/02(15)	0.423	572	486	1.10	442
362E		11.1	3.94	75.6	105	09/17(04)	0.214	34	71.6	1.59	45.0
395W		8.7	2.87	67.1	53	09/08(03)	0.331	<2.2	<3.8	1.56	< 2.4
418W		13.5	5.02	83.9	5/6	08/30(15)	0.500	<2.2	<1.6	2.80(5)	< 0.6
409W		10.5	4.25	113.	65	09/10(21)	0.291	<2.2	<3.6	1.37	< 2.6
359E	08/17	10.6	3.65	79.0	26	09/01(04)	0.487	126	122	1.32	92.4
357E	(08)	14.1	5.15	175.	67	09/10(23)	0.303	40.5	47.4	1.11	42.7
300E		11.2	4.83	76.6	33	09/02(15)	0.454	202	199	1.28	155
421W		10.7	3.82	73.7	95	09/16(16)	0.230	51.8	105	1.04	101
422W		8.8	3.20	60.	99	09/16(21)	0.228	8.5	21.2	1.40	15.1
380W		11.8	5.05	102.	70	09/11(05)	0.300	40.9	57.8	1.38	41.9
365E	08/18	5.9	2.08	41.1	89	09/15(05)	0.259	81.0	265	1.49	178
361E	(08)	14.7	5.75	123.	61	09/10(13)	0.325	461	482	1.38	349
385E		17.2	7.59	135.	150	09/21(12)	0.191	228	347	1.48	234
373W		13.4	4.69	107.	208	09/29(19)	0.140	84.5	225	1.56	144
424W		11.0	4.26	90.1	148	09/23(15)	0.172	45.8	121	1.73	69.9
398W		5.1	1.86	37.3	213	09/29(21)	0.140	23.5	165	1.52	109
307E	08/24	10.6	3.35	80.8	34	09/02(15)	0.631	1,996	1,492	1.28	1,166
449E	(08)	11.4	3.97	20.5(5)	113	09/17(15)	0.305	306	440	1.17	376
276E		8.6	3.46	---	86	09/15(09)	0.344	693	1,171	1.55	755
372W		13.1	4.64	73.1	39	09/02(19)	0.631	266	161	1.03	156
401W		14.3	5.26	109.	74	09/10(15)	0.428	1,080	882	1.21	729
416W		11.0	3.95	94.0	72	09/10(15)	0.428	1,545	1,641	1.39	1,181

A.1-2 cont'd
P-32 Uptake in Catfish
Skin

Fish No.	Date of death, 1982(hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32 Date of counting, 1982 (hr)	P-32 decay fraction	P-32 net c/min.	P-32 c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg
314E	8/26	10.1	3.71	72.0	338	10/19(12)	0.072	256	1,751	1.86	941
369E	(08)	9.7	2.83	79.4	311	10/14(10)	0.092	322	1,796	1.93	931
332E		11.9	4.06	95.2	519	11/06(06)	0.030	94.0	1,295	1.60	809
448W		9.2	3.43	---	620	11/17(04)	0.018	9.3	279	1.29	216
439W		16.6	5.54	107.	664	11/23(08)	0.013	81.8	1,847	1.24	1,490
389W		12.0	4.70	61.3	663	11/23(06)	0.013	32.9	1,028	1.07	961
355E	9/01	14.8	4.72	104.	517	11/06(05)	0.041	133	1,096		
393E	(08)	13.7	4.60	106.	712	11/25(13)	0.016	41.5	947		
348E		7.9	2.76	37.7	777	12/02(17)	0.011	17.0	978		
414W		15.9	5.87	104.	800	12/09(24)	0.0080	15.7	617		
403W		7.9	2.42	44.6	709	11/25(08)	0.016	2.5	98.9		
404W		10.7	4.18	71.4	463	11/03(16)	0.046	117	1,189		
321E	9/10	10.4	3.15	61.0	253	10/07(05)	0.271	71.2	126		
363E	(08)	13.3	4.68	89.6	233	10/06(08)	0.284	512	678		
356E		3.7	1.25	24.3	265	10/07(07)	0.271	13.6	67.8		
387W		13.3	4.19	107.	249	10/07(20)	0.264	563	802		
429W		9.6	2.91	69.9	264	10/08(16)	0.254	303	621		
431W		15.7	4.63	108.	250	10/08(04)	0.260	259	317		
428W	9/23	18.3	5.97	140.	350	10/21(11)	0.256	902	963		
410W	(08)	11.1	3.13	80.6	346	10/19(12)	0.281	384	616		
390W		12.8	4.54	80.0	354	10/21(11)	0.256	146	223		

A.1-2 cont'd
P-32 Uptake in Catfish
Head

Fish No.	Date of death, 1982(hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32 Date of counting, 1982 (hr)	P-32 decay fraction	P-32 net c/min.	P-32 c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg.
351E	08/16	47.1	16.3	4,510	14	08/31(17)	0.472	1,734	390	20.1	19.4
317E	(08)	55.9	21.5	5,430	46**	09/08(13)	0.325	1,316	905	26.1	34.7
362E		55.6	18.9	5,100	203	09/30(16)	0.111	212	172	20.7	8.31
395W		55.5	18.6	4,880	342*	10/19(23)	0.044	6.7	27.4	22.3	0.81
418W		44.3	18.1	4,270	143	09/23(13)	0.157	5.9	4.2	24.1	0.17
409W		51.1	18.3	4,490	29	09/01(03)	0.465	19.0	4.0	16.8	0.24
359E	08/17	48.4	16.6	4,670	31*	09/01(10)	0.481	676	299	19.0	15.7
357E	(08)	23.3	8.36	2,190	25	09/01(00)	0.490	116	50.8	20.4	2.49
		36.6	14.8	3,510	187	09/28(21)	0.127	54.5	58.6	23.2	2.53
300E		17.1	6.83	1,010	205	09/30(17)	0.117	201	502	22.0	22.8
		23.8	9.58	2,590	32	09/01(10)	0.481	783	342	25.7	13.3
		11.4	5.15	1,190	188	09/28(23)	0.127	158	546	29.5	18.5
421W		52.7	20.5	6,020	196	09/30(13)	0.117	270	219	29.2	7.5
422W		18.0	6.17	1,540	144	09/23(13)	0.165	5.0	8.4	22.4	0.38
		15.8	6.04	1,610	237	10/06(20)	0.087	2.6	9.5	31.1	0.31
380W		38.1	15.4	4,330	189	09/28(24)	0.127	113	117	25.2	4.64
		23.1	9.71	2,560	60*	09/08(16)	0.336	77.2	99.4	30.0	3.31
365E	08/18	30.8	11.3	2,770	209	09/30(18)	0.122	519	691	19.6	35.3
361E	(08)	58.3	22.1	5,930	214	09/30(19)	0.122	1,680	1,181	23.2	50.9
385E		57.3	23.9	5,750	210	09/30(18)	0.122	787	563	22.3	25.2
373W		51.5	19.2	5,190	211	09/30(18)	0.122	488	388	19.9	19.5
424W		43.8	17.8	4,250	207	09/30(17)	0.122	239	224	21.1	10.6
398W		23.8	8.60	2,030	212	09/30(19)	0.122	314	541	20.3	26.7
307E	08/24	53.7	20.3	5 600	181	09/24(14)	0.220	10,530	4,460	20.6	217.
449E	(08)	65.8	24.2	6,380	217	09/30(20)	0.162	1,848	867	20.8	41.7
276E		34.9	15.1	3,460	190	09/30(12)	0.165	4,303	3,310	22.5	147.
372W		60.2	23.7	5,770	215	09/30(19)	0.162	618	317	23.4	13.5
401W		64.1	23.5	6,180	180	09/24(14)	0.220	3,705	1,314	22.5	58.4
416W		59.1	18.4	5,810	45*	09/18(13)	0.527	8,020	2,580	26.4	97.7

A.1-2 cont'd
P-32 Uptake in Catfish
Head

Fish No.	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32: Date of counting, 1982 (hr)	P-32: decay fraction	P-32: net c/min.	P-32: c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg.
314E	8/26	56.1	20.1	4,920	332	10/15(12)	0.096	2,445	2,270	19.9	114
369E	(08)	57.7	19.3	5,220	287	10/13(08)	0.097	3,818	3,400	21.1	161
332E		52.0	18.5	4,740	448	11/03(13)	0.035	555	1,514	17.4	87.0
448W		40.8	15.0	3,840	295	10/13(09)	0.097	551	695	21.9	31.7
439W		80.6	26.8	6,530	543	11/07(12)	0.029	1,358	2,950	20.0	148.
389W		59.4	23.9	5,570	495	11/04(17)	0.033	780	1,969	22.6	87.1
355E	9/01	72.6	24.9	6,440	626	11/17(15)	0.024	978	2,810		
393E	(08)	58.5	21.0	5,880	616	11/17(12)	0.024	410	1,460		
348E		44.1	16.7	4,340	499	11/04(18)	0.044	1,632	4,200		
414W		63.2	25.2	5,970	621	11/17(13)	0.024	399	1,315		
403W		37.9	14.4	4,070	623	11/17(05)	0.024	18.1	99.5		
404W		55.5	20.7	5,370	397	10/25(14)	0.072	2,342	2,930		
321E	9/10	54.0	18.2	5,510	243	10/07(19)	0.264	882	309		
363E	(08)	73.7	22.8	5,740	246	10/07(20)	0.264	4,181	1,074		
356E		20.3	6.53	1,930	223	09/30(21)	0.370	420	280		
387W		54.8	18.0	4,910	226	09/30(21)	0.370	7,634	1,883		
429W		51.8	16.1	5,300	242	10/07(19)	0.264	4,623	1,690		
431W		64.0	20.8	6,170	244	10/07(19)	0.264	1,713	507		
428W	9/23	71.0	23.6	6,210	294	10/13(09)	0.379	20,980	3,900		
410W	(08)	61.9	19.0	5,110	307	10/13(16)	0.374	8,604	1,858		
390W		55.0	18.9	5,190	304	10/13(12)	0.376	1,706	412		

A.1-2 cont'd
P-32 Uptake in Catfish
Fins

Fish No.	Date of death, 1982 (hr)	Weight,			Sample No.	P-32				P, mg/g wet	P-32/P, c/min.mg.
		wet	dry	ashed		Date of counting, 1982 (hr)	decay fraction	net c/min.	c/min.g. wet		
351E	08/16	3.8	1.19	244	58	09/08(15)	0.320	131	539	17.3	31.2
317E	(08)	7.6	2.63	371	9/10	08/31(14)	0.477	680	938	13.6	69.0
362E		5.2	1.78	303	166	09/24(21)	0.147	26.8	175	13.7	12.8
395W		5.6	2.24	335	57	09/08(06)	0.330	<2.2	< 6.0	14.5	< 0.4
418W		5.1	2.39	265	52	09/07(23)	0.334	<2.2	< 6.5	12.8	< 0.5
409W		5.8	2.30	359	141	09/23(13)	0.156	<2.2	<12.2	14.0	< 0.9
359E	08/17	5.6	2.05	289	169	09/25(02)	0.152	53.2	312	12.7	24.6
357E	(08)	6.1	2.40	351	171	09/25(05)	0.152	35.0	189	12.3	15.4
300E		6.4	3.26	389	170	09/25(03)	0.152	77.0	396	9.8	40.4
421W		5.3	2.22	398	30	09/01(07)	0.484	132	257	18.3	14.0
422W		3.9	1.43	---	lost sample						----
380W		5.8	2.67	377	145	09/23(14)	0.164	25.9	136	15.6	8.72
365E	08/18	2.9	1.20	188	173	09/25(09)	0.159	71.6	776	13.4	57.9
361E	(08)	7.2	2.70	393	191	09/30(13)	0.123	174	982	14.2	69.2
385E		5.9	2.75	335	177	09/25(15)	0.156	130	706	12.8	55.2
373W		5.9	2.32	379	234	10/06(18)	0.087	49.6	483	13.4	36.0
424W		5.8	2.25	306	174	09/25(10)	0.159	45.8	248	14.0	17.7
398W		2.1	0.90	133	178	09/25(17)	0.156	33.2	507	15.0	33.8
307E	08/24	5.5	2.10	321	155	09/21(14)	0.255	1,044	3,720	14.5	257.
449E	(08)	6.4	2.75	431	216	09/30(19)	0.162	171	825	17.1	48.2
276E		3.8	1.70	248	138	09/21(11)	0.255	358	1,847	16.7	110.
372W		6.1	2.62	336	184	09/28(18)	0.186	83.1	366	13.6	26.9
401W		6.5	2.97	1,120(5)	179	09/24(14)	0.220	489	1,710	14.3	120.
416W		5.0	1.94	332	43	09/02(18)	0.635	1,850	2,910	15.2	191.

A.1-2 cont'd
P-32 Uptake in Catfish
Fins

Fish No.	Date of death, 1982(hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32: Date of counting, 1982 (hr)	P-32: decay fraction	P-32: net c/min.	P-32: c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg.
314E	8/26	6.6	2.69	323	611	11/16(23)	0.018	56.1	2,350	9.52	246.
369E	(08)	5.7	2.03	332	364	10/21(12)	0.066	254	2,930	13.9	211.
332E		5.6	2.02	344	487	11/05(14)	0.031	58.2	1,653	15.1	109.
448W		4.4	1.61	283	710	11/25(10)	0.012	5.3	486	14.0	34.7
439W		9.4	3.19	493	490	11/04(15)	0.033	153	2,440	12.1	202.
389W		7.4	3.07	347	393	10/25(13)	0.054	140	1,742	13.3	131.
355E	9/01	6.4	2.71	417	542	11/07(11)	0.039	126	2,520		
393E	(08)	5.2	2.09	357	655	11/22(19)	0.018	26.4	1,410		
348E		7.9(5)	1.38	167	629	11/17(18)	0.023	50.3	1,384		
414W		6.6	3.10	418	524	11/06(11)	0.041	62.1	1,147		
403W		4.0	1.01	170	799	12/09(23)	0.0080	<2.2	<340		
404W		6.1	2.28	323	521	11/06(10)	0.041	113	2,260		
321E	9/10	5.3	1.92	364	218	09/29(22)	0.387	153	373		
363E	(08)	8.1	2.98	409	231	09/30(19)	0.372	763	1,266		
356E		2.2	0.83	152	341	10/19(21)	0.146	18.5	288		
387W		6.9	2.64	408	219	10/01(01)	0.367	993	1,961		
429W		5.1	1.82	351	235	10/21(15)	0.135	188	1,365		
431W		5.8	2.50	357	200	09/30(15)	0.372	288	667		
428W	9/23	7.6	2.68	435	348	10/21(10)	0.256	1,163	2,990		
410W	(08)	5.7	1.85	325	353	10/21(10)	0.256	551	1,888		
390W		4.4	1.69	---	349	10/20(04)	0.273	141	587		

A.1-2 cont'd
P-32 Uptake in Catfish
Fin Spines

Fish No.	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32 Date of counting, 1982(hr)	P-32 decay fraction	P-32 net c/min.	P-32 c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg.
351E	08/16	0.55	0.377	211	54	09/08(02)	0.330	53.0	1,460	63.3	23.1
317E	(08)	0.68	0.424	227	48	09/08(13)	0.322	84.8	1,936	80.0	24.2
362E		0.66	0.432	237	165	09/24(20)	0.147	11.1	572	86.7	6.60
395W		0.59	0.411	232	140	09/23(15)	0.156	<2.2	<120	86.9	< 2
418W		0.65	0.468	269	56	09/08(05)	0.330	<2.2	< 51	98.0	< 0.6
409W		0.63	0.448	238	142	09/08(18)	0.322	<2.2	< 54	73.2	< 0.8
359E	08/17	0.60	0.415	227	168	09/24(01)	0.161	17.4	901	88.2	10.2
357E	(08)	0.80	0.522	281	186	09/28(20)	0.127	6.7	330	83.9	3.93
300E		0.77	0.573	354	20	08/31(06)	0.510	75.9	966	133.0	7.26
421W		0.81	0.603	338	167	09/24(23)	0.154	10.6	425	80.5	5.28
422W		0.44	0.326	183	172	09/25(09)	0.151	<2.2	<170	88.6	< 2
380W		0.62	0.478	272	40	09/02(24)	0.445	16.6	301	98.5	3.06
365E	08/18	0.55	0.379	208	147	09/24(05)	0.166	38.8	2,120	90.3	23.5
361E	(08)	0.81	0.589	321	176	09/25(16)	0.156	71.6	2,830	103.6	27.3
385E		0.35	0.260	144	161	09/24(10)	0.166	20.5	1,764	124.5	14.2
373W		0.84	0.603	333	146	09/23(24)	0.169	20.9	736	93.5	7.87
424W		0.51	0.369	211	175	09/25(14)	0.156	12.0	754	109.8	6.87
398W		0.29	0.210	118	194	09/29(03)	0.132	12.7	1,659	109.4	15.2
307E	08/24	0.64	0.428	228	137	09/21(10)	0.254	619	19,040	76.4	249.
449E	(08)	0.75	0.563	318	139	09/23(13)	0.231	87.5	2,520	122.7	20.5
276E		0.49	0.837(5)	672(5)	154	09/21(13)	0.255	232	9,280	104.9	88.5
372W		0.74	0.550	310	149	09/24(07)	0.222	23.5	715	Lost	----
401W		0.80	0.605	342	151	09/21(12)	0.254	92.0	2,260	91.9	24.6
416W		0.64	0.491	272	136	09/21(10)	0.254	306	9,410	99.6	94.5

A.1-2 cont'd
P-32 Uptake in Catfish
Fin Spines

Fish No.	Date of death, 1982 (hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32 Date of counting, 1982 (hr)	P-32 decay fraction	P-32 net c/min.	P-32 c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg.
314E	8/26	0.62	0.443	257	612	11/16(24)	0.018	11.2	4,990	72.4	68.9
369E	(08)	0.64	0.445	251	317	10/14(03)	0.094	109	9,030	95.9	94.2
332E		0.61	0.426	241	512	11/05(24)	0.031	14.2	3,710	80.7	46.0
448W		0.58	0.421	237	658	11/22(21)	0.013	2.5	1,615	85.6	18.9
439W		1.10	0.732	408	628	11/17(07)	0.018	19.1	4,800	76.1	63.1
389W		0.72	0.532	308	480	11/04(02)	0.034	17.1	3,460	79.5	43.5
355E	9/01	0.71	0.509	277	386	10/21(02)	0.089	98.5	7,790		
393E	(08)	1.12(5)	0.460	269	642	11/18(02)	0.023	4.6	893		
348E		0.68	0.424	253	667	11/23(22)	0.017	22.8	9,860		
414W		0.75	0.558	311	400	10/21(08)	0.089	29.6	2,220		
403W		0.48	0.408	239	666	11/23(20)	0.017	<2.2	<1,400		
404W		0.43	0.315	179	544	11/07(14)	0.038	24.6	7,530		
321E	9/10	0.59	0.357	219	268	10/07(10)	0.269	39.8	1,254		
363E	(08)	0.89	0.511	305	232	09/30(02)	0.383	187	2,740		
356E		0.30	0.213	134	248	10/07(04)	0.273	10.1	617		
387W		0.52	0.343	216	352	10/21(08)	0.137	92.1	6,460		
429W		0.46	0.332	212	240	10/07(18)	0.265	163	6,690		
431W		0.79	0.528	331	239	10/06(21)	0.277	3.8	1,229		
428W	9/23	0.63	0.376	225	351	10/20(05)	0.272	382	11,150		
410W	(08)	0.21	0.109	62.6	345	10/20(02)	0.273	47.2	4,120		
390W		0.55	0.311	191	340	10/19(19)	0.277	76.7	2,520		

A.2-1
Bluegill Food

Date of feeding, 1982	Vial No.	Weight, mg. Dry	Ash	amt. fed, g E	W	Number of fish E	W	P-32 counting date, 1982/83	Decay factor	c/min net	c/min.g.	P,mg/g wet wt	P-32/P, c/min.mg
09/27	536	595	---	104.	204	55	51	11/07(01)	0.139	5,217	93,800		
28	504	144	---	99.3	196.3	52	48	11/04(19)	0.162	5,917	91,300		
29			---	93.9	185.5	49	45						
30	529	160	---	88.5	174.7	46	42	11/04(24)	0.177	5,264	74,400		
10/01			---	10.0	32.0	46	42						
02			---	88.5	104.5	46	42						
03	507		16.8	88.5	174.7	46	41	11/04(20)	0.207	1,887	22,800	1.37	16,642
04				88.5	174.7	46	41						
05	442		---	78.0	120.2	46	41	10/26(03)	0.365	2,269	15,540	1.13	13,752
06	505		9.4	65.2	92.3	43	38	11/04(19)	0.239	400	4,180	0.77	5,421
07	506		12.9	78.1	128.	43	38	11/04(19)	0.251	843	8,400	1.22	6,885
08	530		14.1	78.2	163.	43	38	11/04(24)	0.261	513	4,910	1.21	4,058
09	527		17.6	78.4	112.5	43	38	11/04(23)	0.275	1,815	16,500	1.38	11,956
10	535		14.6	78.3	172.	43	38	11/06(23)	0.262	992	9,470	1.30	7,284
11	534		17.6	78.2	71.0	43	38	11/06(22)	0.275	717	6,520	1.32	4,939
12	528		13.8	83.1	145.3	40	35	11/04(23)	0.319	655	5,130	1.13	4,540
13				75.3	65.1	40	35						
14		feed not eaten		0.0	0.0	40	35						
15	1111	301	21.2	83.2	129.5	40	34	01/19(20)	0.0095	19.0	5,000	1.30	3,846
16	1112	355	24.5	95.1	125.5	40	34	01/19(22)	0.0099	41.8	10,560	1.51	6,993
17	1113	233	18.2	83.2	110.5	40	34	01/19(24)	0.0104	20.2	4,860	0.98	4,985
18	1114	305	21.2	83.5	150.2	40	34	01/20(01)	0.0109	16.4	3,760	1.30	2,892
19	1115	332	21.4	65.2	125.4	37	31	01/20(03)	0.0113	13.8	3,050	1.44	2,118
20	1116	254	18.4	65.5	155.2	37	31	01/20(04)	0.0119	12.8	2,690	1.07	2,514
21	1117	320	20.8	55.2	45.4	37	31	01/20(06)	0.0124	47.0	9,480	1.48	6,405
22	1118	311	21.2	52.5	75.3	37	31	01/20(11)	0.0129	37.5	7,270	1.32	5,508
23	1119	304	17.5	85.2	125.6	37	31	01/20(12)	0.0135	56.0	10,370	1.33	7,797
24	1120	292	18.6	90.1	120.5	37	31	01/20(14)	0.0142	38.0	6,690	1.24	5,395
25	1121	295	17.3	90.0	85.0	37	31	01/20(16)	0.0148	33.2	5,610	1.20	4,675
26	1122	252	16.3	75.2	84.3	34	28	01/20(17)	0.0155	45.4	7,320	1.03	7,106
27	1123	273	15.2	65.3	65.7	34	28	01/20(19)	0.0162	51.4	7,930	1.17	6,777
	1124	300	17.2					01/20(21)	0.0162	69.8	10,770	1.35	7,977
28	1125	321	17.2	50.3	61.5	34	28	01/20(22)	0.0169	95.4	14,110	1.45	9,731
29	1126	288	15.8	60.3	120.5	34	28	01/20(24)	0.0177	38.2	5,400	1.43	3,776
30	1127	264	14.7	90.2	155.0	34	28	01/21(02)	0.0185	63.8	8,620	1.11	7,766
31	1128	268	14.5	90.	150.	34	28	01/21(03)	0.0194	60.2	7,760	1.11	6,991

A.2-1 cont'd
Bluegill Food

Date of feeding, 1982	Vial No.	Weight, mg. Dry	Weight, mg. Ash	amt. fed, g E	amt. fed, g W	Number of fish E	Number of fish W	P-32 counting date, 1982/83	P-32 Decay factor	P-32 c/min net	P-32 c/min.g	P,mg/g wet wt	P-32/P, c/min.mg
11/01	1129	287	16.1	85.2	20.1	34	28	01/21(05)	0.020	45.8	5,720	1.14	5,018
02	1130	232	13.4	80.1	105.2	29	25	01/21(07)	0.021	67.4	8,020	1.05	7,638
03	1131	219	12.4	65.3	110.5	29	25	01/21(08)	0.022	62.0	7,050	0.93	7,580
04	1132	279	15.0	40.5	90.2	29	25	01/21(10)	0.023	50.1	5,450	1.15	4,739
05	1134	212	12.3	71.3	103.4	29	25	01/21(13)	0.024	45.0	4,690	0.88	5,317
06	1135	254	13.7	61.7	111.8	29	25	01/21(15)	0.025	39.5	3,950	1.11	3,559
07	1136	297	14.8	50.8	101.3	29	25	01/21(17)	0.027	107.	9,910	1.23	8,057
08	1137	212	12.3	60.1	81.3	29	25	01/21(18)	0.028	67.2	6,000	0.94	6,417
09	1138	315	15.1	55.2	85.6	26	22	01/21(20)	0.029	5.6	483	1.35	358
10	1139	282	15.3	42.3	78.2	26	22	01/21(22)	0.030	73.0	6,080	1.24	4,903
11	1140	374	19.2	40.5	55.3	26	22	01/21(23)	0.032	277.	21,640	1.66	13,036
12	1141	308	15.8	25.3	42.6	26	22	01/22(01)	0.033	123.	9,320	1.32	7,060
13	1142	291	15.6	38.5	63.2	26	22	01/22(03)	0.035	133.	9,500	1.28	7,422
14	1143	243	14.0	50.3	72.6	26	22	01/22(04)	0.036	102.	7,080	1.10	6,436
15	1144	314	16.5	55.1	85.3	26	22	01/22(06)	0.038	116.	7,630	1.45	5,262
16	1145	307	16.7	41.3	70.4	26	22	01/22(08)	0.039	117	7,500	1.30	5,769
Average for period 10/06 - 11/16 (± standard deviation of mean)												1.23 ± 0.03	6,020 ± 370

Notes: 1. Feed samples were worms, 2 g moist weight; 20-ml aliquots of 100-ml samples were counted
2. Amount fed is moist weight; total amount was based on estimated fish weight, as 1.5% (E) or 3.0% (W) of body weight. Lesser amounts were fed if fish reduced their intake.

A.2-2
Catfish Food

Date of feeding, 1982	Vial No.	Dry wt., g	Amt fed, g E	Amt fed, g W	Number of fish E	Number of fish W	P-32 counting date, 1982/83	P-32 Decay factor	P-32 c/min net	P-32 c/min.g	P,mg/g dry wt	P-32/P, c/min.mg
08/15	438	0.98	238.2	151.2	69	69	10/26(02)	0.031	629	103,500	13.5	7,670
16			47.8	33.5	65	64						
17			89.0	34.2	62	60						
18	423	0.94	78.7	50.7	59	55	10/25(21)	0.036	672	99,300	12.5	7,940
19			77.9	115.2	59	55						
20			26	18.1	58	54						
21	430	0.96	156	81	58	50	10/25(23)	0.042	741	91,900	13.4	6,860
22			148	100	58	50						
23			86	40	55	50						
24			129	65	52	47						
25	436	1.02	142	119	52	47	10/26(01)	0.050	937	91,900	14.5	6,340
26			20	20	9	15						
27	431	1.03	20	20	6	12	10/25(24)	0.055	1,070	94,400	14.2	6,650
28			14.7	13.2	6	12						
29			4.9	4.6	6	12						
30	429	1.04	7.0	9.2	6	12	10/25(23)	0.065	1,238	91,600	13.0	7,046
	434	1.05					10/26(01)	0.065	1,203	88,100	14.6	6,034
31			1.3	2.3	6	12						
09/01			8.8	3.4	3	9						
02	425	0.98	4.3	10.0	3	9	10/25(22)	0.071	659	47,400	14.4	3,292
03			6.6	9.3	3	9						
04			4.8	15.0	3	9						
05	427	1.01	4.2	8.6	3	9	10/25(22)	0.082	801	48,400	14.4	3,361
06			2.1	8.8	3	9						
07			3.1	8.8	3	9						
08	421	1.00	2.9	15.0	3	9	10/25(20)	0.095	904	47,600	13.2	3,606
09			3.3	9.6	3	9						
10			---	1.2	0	6						
11	424	0.98	---	3.5	0	6	10/25(21)	0.110	1,119	51,900	15.1	3,437
12			---	3.0	0	6						
13					0	6						
14	422	0.98	---	12.0	0	6	10/25(21)	0.127	1,209	48,600	14.6	3,329
	428	1.01					10/25(23)	0.127	1,158	45,100	15.8	2,854

A.2-2 cont'd
Catfish Food

Date of feeding, 1982	Vial No.	Dry wt., g	Amt fed, g		Number of fish		P-32				P,mg/g dry wt	P-32/P, c/min.mg
			E	W	E	W	counting date, 1982/83	Decay factor	c/min net	c/min.g		
09/15				5.2	0	6						
16				5.3	0	6						
17	426	1.00	---	9.9	0	6	10/25(22)	0.147	1,337	45,500	14.7	3,095
18				8.3	0	6						
19				10.6	0	6						
20				9.	0	6						
21	435	1.02	---	3.1	0	6	10/26(01)	0.177	1,543	42,700	13.5	3,163
22					0	6						
23				1.2	0	3						
Average for period 08/15 - 08/27 (± std. dev. of mean)											13.6 ± 0.4	7,090 ± 300

Notes: 1. 20-ml aliquots of 100-ml samples were counted.
2. Amount fed was based on estimated fish weight, as 2.0% (E) or 1.0 % (W) of body weight. Lesser amounts were fed if fish reduced their intake.

A.3-1

P-32 in Water During Bluegill Uptake and Depuration Study

Collection date, 1982 (hour)	Sample	Vial No.	P-32 Counting date, 1982-1983 (hr)	Decay fraction	net c/min.	c/min / L	c/min. / fish.day	P, mg/L	P-32/P, c/min.mg.
11/09 (17)	E - 1 water*	1106	01/14(22)	0.040	2.2	68.8	952	----	----
	1 filter*	1146	01/22(09)	0.028	<2.2	<98	<1,400	0.034	<3,000
	W - 1 water*	1105	01/14(14)	0.040	16.9	528	7,300	0.41	1,290
	1 filter*	1147	01/22(11)	0.028	<2.2	<98	<1,400	0.023	<5,000
11/20 (11)	E - 1 water no filtration	957	12/23(24)	0.196	141.	450	3,600	----	----
	2 water no filtration	958	12/24(02)	0.195	81.2	260	2,080	0.36	722
	W - 1 water no filtration	955	12/22(15)	0.209	535	1,600	12,800	0.58	2,760
	2 water no filtration	956	12/22(15)	0.209	150	449	3,590	0.53	847
	Inflow	1162	02/02(04)	0.028	<2.2	<49		0.39	<130
11/24 (11)	E - 1 water	1133	01/21(12)	0.060	6.2	65	520	0.71	92
	1 filter	Lost	---	---	---	---	---	----	----
	2 water	1110	01/19(18)	0.065	<2.2	<21	<170	----	----
	2 filter	1151	01/22(18)	0.056	<2.2	<25	<200	0.028	<900
	W - 1 water	1109	01/15(03)	0.081	15.5	120	960	0.69	174
	1 filter	1150	01/22(16)	0.056	3.6	40.2	322	0.082	490
	2 water	1108	01/15(01)	0.081	17.0	131	1,048	0.76	172
	2 filter	1149	01/22(14)	0.056	<2.2	<25	<200	0.057	<500
	Inflow	1164	02/02(09)	0.034	<2.2	<40		0.76	<60

Notes: 1. Four-liter samples were taken from 24-L aquaria (41.5-L on 11/09) and processed to 50-ml volumes. These were filtered and the filters were processed to 50-ml volumes.
2. One asterisk indicates that only a 2-L sample was collected.
3. Two asterisks indicate approximately 15% loss during processing, for which the result was corrected.

A.3-1 cont'd

P-32 in Water During Bluegill Uptake and Depuration Study

Collection date, 1982 (hour)	Sample	Vial No.	Counting date, 1982-1983 (hr)	P-32				P, mg/L	P-32/P, c/min.mg.
				Decay fraction	net c/min.	c/min L	c/min. fish.day		
11/30 (15)	E - 1 water	1152	01/22(19)	0.075	4.2	35.0	280	----	----
	1 filter	1183	02/03(22)	0.042	<2.2	<33.	<270	0.057	<600
	2 water	1153	01/22(21)	0.075	3.3	27.5	220	0.99	27.8
	2 filter	1184	02/03(24)	0.042	<2.2	<33.	<270	0.051	<500
	W - 1 water	1107	01/14(24)	0.109	65.3	374	2,990	----	----
	1 filter	1148	01/22(13)	0.076	6.0	49.3	394	0.033	1,494
	2 water	1157	01/28(17)	0.056	53.2	594	4,750	0.80	742
	2 filter	1188	02/04(06)	0.041	3.2	48.8	390	0.029	1,683
12/07 (11)	E - 1 water	1155	01/28(14)	0.079	<2.2	<17	<140	0.95	<18
	1 filter	1186	02/04(03)	0.058	<2.2	<24	<200	0.028	<900
	2 water	1156	01/28(16)	0.079	<2.2	<17	<140	0.90	<19
	2 filter	1187	02/04(05)	0.058	<2.2	<24	<200	0.044	<600
	W - 1 water	1158	01/28(19)	0.079	6.4	50.6	405	0.56	90.4
	1 filter	1189	02/04(10)	0.057	<2.2	<24	<200	0.049	<500
	2 water	1154	02/01(23)	0.064	4.3	42.0	336	0.45	93.3
	2 filter	1185	02/04(02)	0.058	<2.2	<24	<200	0.013	<1,900
12/15 (11)	E - 1 water	1161	02/02(02)	0.094	<2.2	<15	<120	0.45	<40
	1 filter	1192	02/04(15)	0.084	<2.2	<16	<130	0.013	<1,300
	2 water	1163	02/02(05)	0.094	<2.2	<15	<120	----	----
	2 filter	1216	02/08(22)	0.068	<2.2	<20	<160	<0.06	----
	W - 1 water	1159	01/28(21)	0.115	<2.2	<12	<100	0.59	<20
	1 filter	1190	02/04(12)	0.084	<2.2	<16	<130	0.018	<900
	2 water**	1160	02/01(24)	0.094	<2.2	<17	<140	0.72	<30
	2 filter	1191	02/04(13)	0.084	<2.2	<16	<130	0.014	<1,200

P-32 in Suspended Solids During Bluegill Uptake and Depuration Study

Collection date, 1982 (hr)	Sample	Vial No.	P-32 Counting date, 1982-1983 (hr)	Decay fraction	net c/min.	c/min. L	c/min. fish.day	P, mg/L	P-32/P, c/min.mg
11/09 (17)	E-large	945	12/23(16)	0.125	12.0	11.6	160	0.018	640
	E-250 μ	944	12/22(06)	0.127	21.7	20.6	285	0.011	1,900
	E-75 μ	811	12/11(05)	0.217	66.5	36.9	510	0.022	1,700
	E-0.45μ(4)	1042	01/07(20)	0.057	<2.2	<380	<5,300	<0.2	---
		808	12/10(04)	0.228	<2.2	<100	<1,400	<0.2	---
		814	12/11(08)	0.216	2.4	110	1,520	<0.2	---
		809	12/10(06)	0.228	<2.2	<100	<1,400	<0.2	---
	W-large	810	12/11(03)	0.218	5.4	3.0	41	0.0020	1,500
	W-250μ	1008	12/31(10)	0.082	9.6	14.1	195	0.0052	2,700
	W-75μ	922	12/21(15)	0.131	39.3	36.1	499	0.024	1,500
	W-0.45μ(4)	923	12/21(17)	0.131	<2.2	<170	<2,400	<0.2	---
		940	12/22(03)	0.128	<2.2	<170	<2,400	<0.2	---
		924	12/21(18)	0.130	<2.2	<170	<2,400	<0.3	---
		941	12/22(04)	0.128	<2.2	<170	<2,400	<0.3	---
11/20 (11)	E	1167	02/02(14)	0.027	3.9	30	240	0.017	1,760
	W	1172	02/02(22)	0.027	<2.2	<17	<140	0.018	<1,000
11/24 (11)	E	1174	02/03(02)	0.032	<2.2	<14	<120	0.011	<1,300
	W	1168	02/02(16)	0.033	<2.2	<14	<120	0.013	<1,100
11/30 (15)	E	1169	02/02(17)	0.046	<2.2	<10	<80	0.027	<400
	W	1171	02/02(20)	0.046	<2.2	<10	<80	0.018	<600
12/07 (11)	E	1173	02/02(24)	0.061	<2.2	<8	<70	0.018	<500
	W	1170	02/02(19)	0.062	<2.2	<8	<70	0.017	<500
12/15 (11)	E	1166	02/02(12)	0.093	<2.2	<5	<40	0.013	<400
	W	1165	02/02(10)	0.093	<2.2	<5	<40	0.0051	<1,000

Notes;
1. For 11/09 samples, water volume was 41.5 L but only 0.50 L was passed through each 0.45 filter; samples were made up to 100 ml
2. For all other samples, water volume was 24 L and samples were made up to 100 ml
3. Large solids were collected on 11/09 with a small net; solids were collected on all other dates by siphoning them from the aquarium bottom and retaining them on a 75-μ filter

A.4-1
Bluegill Wet Weight in Flow-through Tank

	Weight, g				Weight gain, d^{-1}		
Fish No.	09/03	10/01	11/12	Death Date	09/03 on	10/01 on	11/12 on
				09/28			
761 E	118.0			114.5	-0.001		
794 E	130.0			119.6	-0.003		
879 E	151.0			153.3	0.001		
499 W	121.0			121.6	0.002		
708 W	111.0			123.6	0.004		
787 W	142.5			149.4	0.002		
Avg E					-0.001		
Avg W					0.002		
				09/29			
684 E	159.0			156.5	-0.001		
859 E	133.5			139.8	0.002		
863 E	95.0			93.6	-0.001		
608 W	102.5			107.9	0.002		
682 W	137.0			148.7	0.003		
890 W	126.0			139.7	0.004		
Avg E					0.000		
Avg W					0.003		
				09/30			
619 E	106.5			122.4	0.005		
872 E	152.0			153.5	0.000		
635 E	135.0			142.5	0.002		
706 W	131.0			133.8	0.001		
704 W	121.5			119.2	-0.001		
480 W	150.6			158.5	0.002		
Avg E					0.002		
Avg W					0.001		

Notes: 1. Fish were initially weighed before P-32 feeding was begun on 09/27.
2. Weighing on 10/01 was not used to compute weight changes for fish killed on 10/06, and weighing on 11/12 was not used to compute weight change for fish killed on 11/17 because of short time interval.

A.4-1 cont'd
Bluegill Wet Weight in Flow-through Tank

Fish No.	Weight, g				Weight gain, d^{-1}		
	09/03	10/01	11/12	Death Date	09/03 on	10/01 on	11/12 on
				10/06			
759 E	113.5	103.9		98.6	-0.004		
674 E	95.0	101.1		102.4	0.002		
762 E	122.5	119.8		114.0	-0.002		
613 W	96.0	102.7		103.5	0.002		
680 W	80.5	84.5		82.4	0.001		
792 W	105.0	114.4		109.2	0.001		
Avg E					-0.001		
Avg W					0.001		
				10/12			
699 E	143.0	142.8		147.2	0.000	0.003	
784 E	138.9	153.1		148.3	0.003	-0.003	
733 E	---	109.4		107.6	---	-0.002	
488 W	110.9	115.3		118.5	0.001	0.002	
490 W	85.6	93.3		98.5	0.003	0.005	
476 W	153.5	163.1		164.9	0.002	0.001	
Avg E					0.001	-0.001	
Avg W					0.002	0.003	
				10/19			
769 E	94.0	101.0		101.4	0.003	0.000	
482 E	94.6	92.0		92.9	-0.001	0.000	
677 E	119.0	105.2		116.1	-0.004	0.005	
497 W	81.0	83.4		86.9	0.001	0.002	
873 W	132.0	149.5		161.4	0.004	0.004	
607 W	164.0	159.3		172.4	-0.001	0.004	
Avg E					-0.001	0.002	
Avg W					0.001	0.003	

A.4-1 cont'd
Bluegill Wet Weight in Flow-through Tank

Fish No.	Weight, g 09/03	10/01	11/12	Death Date	Weight gain, d^{-1} 09/03 on	10/01 on	11/12 on
				10/26			
876 E	93.0	99.5		105.0	0.002	0.002	
763 E	129.0	132.8		140.5	0.001	0.002	
881 E	89.5	88.1		85.9	-0.001	-0.001	
785 W	130.5	135.5		147.6	0.001	0.003	
716 W	---	135.7		148.6	---	0.004	
875 W	145.0	153.5		158.2	0.002	0.001	
Avg E					0.001	0.001	
Avg W					0.002	0.003	
				11/03			
882 E	119.0	111.2		117.0	-0.002	0.002	
456 E	89.5	91.4		91.5	0.001	0.000	
627 E	130.0	141.8		151.1	0.003	0.002	
858 E	149.0	148.2		149.7	0.000	0.000	
722 E	125.0	124.1		126.4	0.000	0.001	
884 W	106.0	117.0		116.7	0.004	0.000	
672 W	121.0	118.1		119.7	-0.001	0.000	
679 W	140.0	148.6		154.7	0.002	0.001	
Avg E					0.000	0.001	
Avg W					0.002	0.000	
				11/09			
799 E	122.0	118.5		124.1	-0.001	0.001	
790 E	120.5	135.7		132.6	0.004	-0.001	
486 E	146.0	134.4		132.6	-0.003	0.000	
602 W	134.5	136.6		135.0	0.001	0.000	
893 W	119.0	109.1		118.0	-0.003	0.002	
798 W	150.5	161.7		169.2	0.003	0.001	
Avg E					0.000	0.000	
Avg W					0.000	0.001	

A.4-1 cont'd
Bluegill Wet Weight in Flow-through Tank

Fish No.	Weight, g 09/03	10/01	11/12	Death Date	Weight gain, d^{-1} 09/03 on	10/01 on	11/12 on
				11/17			
899 E	118.0	117.3	120.2	120.8	0.000	0.001	
713 E	93.0	94.0	94.5	96.9	0.000	0.001	
880 E	129.0	120.1	120.5	118.8	-0.003	0.000	
886 W	124.0	135.6	155.2	162.7	0.003	0.004	
622 W	118.5	126.9	139.9	145.0	0.002	0.003	
698 W	135.0	139.1	144.7	146.9	0.001	0.001	
Avg E					-0.001	0.001	
Avg W					0.002	0.003	
				11/20			
782 E	142.0	155.0	160.6	160.0	0.003	0.001	0.000
767 E	159.0	166.0	172.4	171.3	0.002	0.001	-0.001
728 E	---	149.0	164.6	162.7	---	0.002	-0.001
715 W	---	151.7	164.2	166.0	---	0.002	0.001
889 W	104.5	154.5	169.8	169.5	---	0.002	0.000
606 W	153.5	175.4	196.5	196.5	0.005	0.003	0.000
Avg E					0.002	0.001	-0.001
Avg W					---	0.002	0.000
				11/24			
477 E	135.0	140.7	148.9	147.0	0.001	0.001	-0.001
738 E	114.0	111.0	115.3	115.7	-0.001	0.001	0.000
691 E	140.0	155.0	161.5	160.7	0.003	0.001	0.000
668 W	131.0	150.3	161.2	161.1	0.005	0.002	0.000
717 W	---	108.9	117.8	118.3	---	0.002	0.000
891 W	135.0	143.3	143.2	143.3	0.002	0.000	0.000
Avg E					0.001	0.001	0.000
Avg W					0.004	0.001	0.000

A.4-1 cont'd
Bluegill Wet Weight in Flow-through Tank

Fish No.	Weight, g 09/03	10/01	11/12	Death Date	Weight gain, d^{-1} 09/03 on	10/01 on	11/12 on
				11/30			
637 E	126.0	132.6	143.7	149.0	0.002	0.002	0.002
721 E	---	106.6	108.7	112.0	---	0.000	0.002
723 E	---	118.6	122.7	128.2	---	0.001	0.002
892 W	153.0	179.1	214.9	225.0	0.006	0.004	0.003
885 W	91.0	102.0	112.4	117.5	0.004	0.002	0.002
636 W	140.5	151.7	164.2	174.7	0.003	0.002	0.003
Avg E					---	0.001	0.002
Avg W					0.004	0.003	0.003
				12/07			
730 E	---	117.6	123.2	125.6	---	0.001	0.001
871 E	112.5	121.9	122.2	122.8	0.003	0.000	0.000
705 E	155.5	148.5	143.7	148.4	-0.002	-0.001	0.001
641 W	96.0	96.4	102.4	109.2	0.000	0.001	0.003
615 W	128.0	146.6	156.1	154.1	0.005	0.001	0.000
735 W	98.0	95.5	105.0	113.2	-0.001	0.002	0.003
Avg E					0.000	0.000	0.001
Avg W					0.001	0.001	0.002
				12/15			
694 E	119.0	120.8	121.9	135.5	0.000	0.000	0.003
485 E	142.0	142.9	161.8	166.6	0.000	0.003	0.001
894 E	160.0	172.1	176.7	184.6	0.003	0.001	0.001
692 W	150.0	161.8	186.5	201.3	0.003	0.004	0.002
854 W	132.0	140.2	155.3	163.3	0.002	0.002	0.002
630 W	104.0	105.6	112.3	121.8	0.000	0.001	0.002
Avg E					0.001	0.001	0.002
Avg W					0.002	0.002	0.002

A.4-2

Catfish Wet Weight in Flow-through Tank

Fish Number	Weight, g Start	Death	Weight gain, d^{-1}
	08/09	08/16	
351 E	175.0	179.7	0.004
317 E	220.0	240.7	0.013
362 E	207.0	209.4	0.002
395 W	193.0	186.8	-0.005
418 W	186.0	179.0	-0.005
409 W	258.0	231.9	-0.015
Avg E			0.006
Avg W			-0.008
		08/17	
359 E	199.0	---	---
357 E	244.0	236.5	-0.004
300 E	227.5	225.5	-0.001
421 W	226.0	---	---
422 W	163.0	155.0	-0.006
380 W	236.0	235.5	0.000
Avg E			-0.002
Avg W			-0.003
		08/18	
365 E	146.0	142.3	-0.003
361 E	261.0	265.6	0.002
385 E	226.5	232.7	0.003
373 W	191.0	193.8	0.002
424 W	193.5	193.3	0.000
398 W	107.0	104.0	-0.003
Avg E			0.001
Avg W			0.000
		08/24	
307 E	201.0	237.8	0.011
449 E	284.0	260.7	-0.006
276 E	157.0	165.1	0.003
372 W	261.0	261.4	0.000
401 W	223.0	244.9	0.006
416 W	211.0	234.1	0.007
Avg E			0.003
Avg W			0.004

Note: Fish were initially weighed before P-32 feeding was begun on 08/15.

A.4-2 cont'd

Catfish Wet Weight in Flow-through Tank

Fish Number	Weight, g Start	Weight, g Death	Weight gain, d^{-1}
	08/09	08/26	
314 E	208.0	250.0	0.011
369 E	196.0	250.0	0.014
332 E	202.0	224.0	0.006
448 W	179.0	173.0	-0.002
439 W	267.0	325.0	0.012
389 W	241.5	270.0	0.007
Avg E			0.010
Avg W			0.006
		09/01	
355 E	243.0	260.7	
393 E	189.0	208.6	
348 E	156.0	181.0	
414 W	254.0	256.3	
403 W	145.5	134.4	
404 W	227.5	226.7	
		09/10	
321 E	200.0	205.8	
363 E	216.0	258.5	
356 E	78.0	70.6	
387 W	201.0	229.7	
429 W	182.0	193.3	
431 W	205.0		
		09/23	
428 W	234.0	297.2	
410 W	185.5	223.7	
390 W	225.0	225.0	

A.5-1

Weight Balances for Dissected Bluegill in Flow-through Tank

Fish No.	Date of death, 1982 (hr)	Total Wet Weight, g Sum	Death Weight	Percent
761E	09/28	106.2	114.5	92.8
794E	(08)	111.7	119.6	93.4
879E		146.3	153.3	95.4
499W		117.0	121.6	96.2
708W		114.7	123.6	92.8
787W		139.3	149.4	93.3
684E	09/29	152.1	156.5	97.2
859E	(08)	136.0	139.8	97.3
863E		89.0	93.6	95.1
608W		101.6	107.9	94.2
682W		136.3	148.7	91.6
890W		133.2	139.7	95.4
619E	09/30	105.4	122.4	86.1
872E	(08)	146.4	153.5	95.3
635E		131.6	142.5	92.4
706W		124.7	133.8	93.2
704W		111.0	119.2	93.1
480W		148.5	158.5	93.7
759E	10/06	98.1	98.6	99.5
674E	(08)	95.1	102.4	92.9
762E		107.1	114.0	94.0
613W		95.2	103.5	92.0
680W		78.0	82.4	94.7
792W		103.7	109.2	95.0
699E	10/12	139.8	147.2	95.0
784E	(08)	141.9	148.3	95.7
733E		103.2	107.6	95.9
488W		111.1	118.5	93.8
490W		92.1	98.5	93.5
476W		158.2	164.9	96.0

A.5-1 (cont'd)

Weight Balances for Dissected Bluegill
in Flow-through Tank

Fish No.	Date of death, 1982 (hr)	Total Wet Weight, g		
		Sum	Death Weight	Percent
769E	10/19	96.3	101.4	95.0
482E	(08)	88.3	92.9	95.0
677E		102.5	116.1	88.2
497W		83.1	86.9	95.6
873W		153.9	161.4	95.3
607W		167.4	172.4	97.1
876E	10/26	98.6	105.0	93.9
763E	(08)	129.7	140.5	92.3
381E		78.2	85.9	91.0
785W		133.9	147.6	90.7
716W		137.8	148.6	92.7
875W		150.0	158.2	94.8
882E	11/03	109.8	117.0	93.9
456E	(08)	87.0	91.5	95.1
627E		146.0	151.1	96.6
858E		143.7	149.7	96.0
722W		121.3	126.4	96.0
884W		111.6	116.7	95.6
672W		112.5	119.7	94.0
679W		146.6	154.7	94.7
799E	11/09	115.8	124.1	93.3
790E	(08)	124.0	132.6	93.5
486E		123.5	132.6	93.2
602W		126.4	135.0	93.6
893W		109.1	118.0	92.4
798W		159.0	169.2	94.0
899E	11/17	113.9	120.8	94.3
713E	(08)	92.2	96.9	95.1
880E		113.0	118.8	95.1
886W		154.1	162.7	94.7
622W		137.1	145.0	94.6
698W		140.0	146.9	95.3

A.5-1 (cont'd)

Weight Balances for Dissected Bluegill
in Flow-through Tank

Fish No.	Date of death, 1982 (hr)	Total Wet Weight, g		
		Sum	Death Weight	Percent
782E	11/20	154.4	160.0	96.5
767E	(08)	163.0	171.3	95.1
728E		154.3	162.7	94.8
715W		155.5	166.0	93.6
889W		161.8	169.5	95.5
606W		190.5	196.5	97.0
477E	11/24	141.2	147.0	96.1
738E	(08)	109.1	115.7	94.3
691E		154.0	160.7	95.8
668W		154.4	161.1	95.8
717W		112.0	118.3	94.7
891W		137.5	143.3	96.0
637E	11/30	141.3	149.0	94.8
721E	(08)	104.3	112.0	93.1
723E		120.5	128.2	94.0
892W		212.4	225.0	94.4
885W		112.9	117.5	96.1
636W		163.8	174.7	93.8
730E	12/07	119.9	125.6	95.5
871E	(08)	119.4	122.8	97.2
705E		140.2	148.4	94.5
641W		101.9	109.2	93.3
615W		144.6	154.1	93.8
735W		106.2	113.2	93.8
694E	12/15	127.5	135.5	94.1
485E	(08)	159.3	166.6	95.6
894E		178.5	184.6	96.7
692W		190.3	201.3	94.5
854W		157.0	163.3	96.1
630W		115.8	121.8	95.0

Weight Balances for Dissected Catfish
in Flow-through Tank

Fish No.	Date of death, 1982 (hr)	Total Wet Weight, g Sum	Death Weight	Percent
351E	08/16	163.5	179.7	91.0
317E	(08)	224.3	240.7	93.2
362E		197.8	209.4	94.5
395W		175.8	186.8	94.1
418W		164.6	179.0	92.0
409W		215.8	231.9	93.1
359E	08/17	181.1	---	---
357E	(08)	222.7	236.5	94.2
300E		207.6	225.5	92.1
421W		202.2	---	---
422W		140.1	155.0	90.4
380W		216.4	235.5	91.9
365E	08/18	134.1	142.3	94.2
361E	(08)	251.8	265.6	94.8
385E		218.7	232.7	94.0
373W		180.2	193.8	93.0
424W		178.5	193.3	92.4
398W		96.1	104.0	92.4
307E	08/24	219.3	237.8	92.2
449E	(08)	248.1	260.7	95.2
276E		149.9	165.1	90.8
372W		244.3	261.4	93.4
401W		233.2	244.9	95.2
416W		216.3	234.1	92.4

A.5-2 (cont'd)

Weight Balances for Dissected Catfish
in Flow-through Tank

Fish No.	Date of death, 1982 (hr)	Total Wet Weight, g		
		Sum	Death Weight	Percent
314E	08/26	234.0	250.0	93.6
369E	(08)	231.3	250.0	92.5
332E		208.9	224.0	93.3
448W		159.5	173.0	92.2
439W		302.8	325.0	93.2
389W		254.5	270.0	94.3
355E	09/01	253.9	260.7	97.4
393E	(08)	192.4	208.6	92.2
348E		177.7	181.0	98.2
414W		240.8	256.3	94.0
403W		126.8	134.4	94.3
404W		215.2	226.7	94.9
321E	09/10	194.8	205.8	94.6
363E	(08)	240.4	258.5	93.0
356E		66.5	70.6	94.2
387W		219.3	229.7	95.5
429W		181.3	193.3	93.8
431W		212.8	---	---
428W	09/23	282.2	297.2	95.0
410W	(08)	214.1	223.7	95.7
390W		212.2	225.0	94.3

B.1-1

P-32 Uptake in Worm-fed Bluegill and Catfish Maintained in Aquaria for Nine Days

Feed %/day	Temp, °C	Fish No.	Weight Wet	Weight Dry	Weight Ash	Sample No.	Counting date, 1983 (hr)	Decay fraction	Net c/min.	c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg
							Bluegill Muscle					
0.87	11	1-1	45.3	9.77	596	1198	02/08(10)	0.559	1,148.	227.	2.66	85.3
		1-2	29.4	6.40	379	1315	02/16(13)	0.377	32.9	14.8	2.64	5.6
		1-3	31.1	6.20	396	1241	02/09(11)	0.531	380.	115.	2.52	45.6
1.6	23	2-1	27.4	5.82	327	1289	02/15(05)	0.402	775.	352.	2.35	150.6
		2-2	25.7	4.92	268	1201	02/07(23)	0.572	39.2	13.3	1.93	6.9
		2-3	43.7	9.43	559	1317	02/15(23)	0.388	4,126	1217.	2.57	474.
2.9	24	3-1	24.6	5.31	307	1262	02/14(20)	0.409	2,325	1,155	2.58	448.
		3-2	24.0	4.14	294	1342	02/16(08)	0.381	329	180	2.39	75.3
		3-3	50.2	11.0	619	1220	02/08(23)	0.545	9,772	1,786	2.62	682.
1.5	27	4-1	33.9	4.22	287	1215	02/08(13)	0.556	1,305	346	1.82	190.
		4-2	27.8	5.39	340	1219	02/08(14)	0.554	1,630	529	2.25	235.
		4-3	41.5	8.87	495	1221	02/08(14)	0.554	1,802	392	2.51	156.
2.4	27	5-1	32.3	4.94	263	1242	02/09(12)	0.530	1,683	492	1.33	370.
		5-2	33.3	6.94	406	1222	02/08(15)	0.554	2,843	771	2.28	338.
		5-3	34.4	7.28	445	1345	02/21(16)	0.294	1,438	711	2.71	262.
2.9	25	6-1	32.8	5.01	310	Lost	---	---	---	---	---	---
		6-2	27.5	4.44	222	1195	02/07(18)	0.577	11.6	3.6	1.31	2.8
		6-3	25.6	5.30	312	1316	02/15(22)	0.389	1,220	562.	2.21	254.
		6-4	51.7	11.5	600	1261	02/14(20)	0.409	6,825	1,614	2.49	648.
							Catfish Muscle					
1.4	27	7-1	92.3	22.9	1,094	1343	02/16(08)	0.381	8,663	1,232	2.50	493.
		7-2	53.6	12.8	603	1287	02/15(05)	0.402	6,454	1,498	2.32	646.
		7-3	51.1	12.1	621	1263	02/14(21)	0.409	1,926	461	2.26	204.
3.0	26	8-1	49.0	11.6	908	1284	02/15(04)	0.403	3,221	816	2.26	361.
		8-2	47.8	11.8	540	1243	02/09(12)	0.530	7,251	1,431	2.26	633.
		8-3	48.4	10.7	549	1255	02/14(18)	0.411	9,783	1,907	2.29	833.

Notes: 1) Exposure period was 01/18-01/27(10) except fish 4-1 was removed on 01/25, 5-1, on 01/26, and 6-1, on 01/20 because of illness, and fish 6-2 was exposed beginning 01/20. 2) Wet and dry wts. are in grams, ash weight is in mg. 3) Duplicate 20-ml aliquots of 100-ml samples were analyzed for P-32 by Cherenkov counting with 50-min. counts when < 200 c/min. and 10-min counts when > 200 c/min.

B.1-1 (cont'd)

P-32 Uptake in Worm-fed Bluegill and Catfish
Maintained in Aquaria for Nine Days

Feed %/day	Temp, °C	Fish No.	Weight Wet	Dry	Ash	Sample No.	Counting date, 1983 (hr)	Decay fraction	Net c/min.	c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg
							Bluegill Skeleton					
0.87	11	1-1	27.2	8.66	2,310	1207	02/08(12)	0.557	1,830	604	14.9	40.5
		1-2	23.6	7.49	2,010	1314	02/15(22)	0.389	144	78.4	15.7	5.00
		1-3	18.5	5.53	1,880	1244	02/09(12)	0.529	638	326	17.6	18.5
1.6	23	2-1	18.7	6.90	1,560	1291	02/15(06)	0.401	1,061	707	16.0	44.2
		2-2	18.0	5.59	1,650	1197	02/07(20)	0.575	44.1	21.3	16.5	1.29
		2-3	33.4	11.4	3,400	1356	02/22(12)	0.282	3,269	1,735	19.8	87.6
2.9	24	3-1	20.8	6.48	1,840	1275	02/15(01)	0.406	3,321	1,966	16.1	122
		3-2	21.4	6.00	2,440	1248	02/14(16)	0.413	494	279	23.7	11.8
		3-3	35.0	11.5	2,840	1274	02/14(24)	0.406	7,363	2,590	15.3	169
1.5	27	4-1	20.0	5.57	2,040	1203	02/08(11)	0.506	1,182	584	19.3	30.3
		4-2	15.7	4.90	1,570	1277	02/15(01)	0.406	2,013	1,579	21.3	74.0
		4-3	33.9	11.1	2,590	1224	02/08(15)	0.551	3,126	837	15.3	54.7
2.4	27	5-1	18.1	5.24	1,890	1240	02/09(11)	0.531	2,566	1,335	19.5	68.5
		5-2	23.3	7.61	2,177	1225	02/08(12)	0.557	4,330	1,668	16.0	104
		5-3	23.6	9.85	2,662	1353	02/22(11)	0.283	2,102	1,574	25.4	619
2.9	25	6-1	18.1	4.84	1,760	1176	02/03(05)	0.513	30.7	16.5	20.0	0.825
		6-2	12.6	3.75	1,350	1200	02/07(22)	0.573	14.8	10.2	20.9	0.488
		6-3	20.8	7.08	2,280	1318	02/15(23)	0.388	1,667	1,033	21.5	48.1
		6-4	30.7	9.52	2,280	1286	02/15(04)	0.403	7,474	3,020	15.3	197
							Catfish Skeleton					
1.4	27	7-1	38.6	12.7	1,604	1340	02/16(07)	0.382	4,319	1,465	8.62	170
		7-2	25.5	8.19	874	1323	02/16(01)	0.386	3,738	1,899	6.51	292
		7-3	34.8	10.9	1,310	1245	02/14(12)	0.416	2,149	742	7.73	96.0
3.0	26	8-1	28.9	8.69	1,100	1321	02/15(24)	0.387	2,139	956	7.08	135
		8-2	24.7	8.52	926	1273	02/14(24)	0.406	4,357	2,170	8.10	268
		8-3	26.7	8.30	945	1352	02/22(11)	0.283	4,563	3,020	6.43	470

P-32 Uptake in Worm-fed Bluegill and Catfish
Maintained in Aquaria for Nine Days

Feed %/day	Temp, °C	Fish No.	Weight Wet	Dry	Ash	Sample No.	Counting date, 1983 (hr)	Decay fraction	Net c/min.	c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg
							Bluegill Viscera					
0.87	11	1-1	11.0	2.69	113	1212	02/08(12)	0.557	4,144	3,380	2.05	1,496
		1-2	6.27	1.55	67.9	1331	02/16(04)	0.384	520	1,080	2.26	478
		1-3	6.70	130.	77.0	1339	02/16(07)	0.382	1,553	3,030	2.07	1,464
1.6	23	2-1	5.53	1.55	56.3	1298	02/15(16)	0.393	1,862	4,280	1.81	2,360
		2-2	5.97	1.25	37.9	1214	02/08(13)	0.556	546	822	1.24	663
		2-3	10.1	2.44	110	1299	02/15(17)	0.393	4,346	5,470	1.85	2,960
2.9	24	3-1	7.19	1.63	68.8	1279	02/15(02)	0.405	3,412	5,860	1.65	3,550
		3-2	3.68	0.516	47.5	1257	02/14(19)	0.410	610	2,020	1.94	1,041
		3-3	11.3	3.97	112	1272	02/14(24)	0.406	4,406	4,800	1.74	2,760
1.5	27	4-1	5.17	0.879	39.3	1196	02/08(10)	0.507	707	1,349	1.72	784
		4-2	3.74	1.08	34.1	1235	02/09(10)	0.533	1,743	4,370	1.53	2,860
		4-3	8.29	2.56	99.6	1232	02/09(09)	0.534	3,310	3,740	1.95	1,918
2.4	27	5-1	6.45	1.06	52.1	1337	02/16(06)	0.383	1,012	2,050	1.58	1,297
		5-2	8.24	1.94	92.7	1234	02/09(10)	0.533	4,603	5,240	2.26	2,320
		5-3	8.57	2.08	105	1341	02/16(08)	0.381	3,881	5,940	2.50	2,380
2.9	25	6-1	6.26	0.870	46.6	1178	02/03(08)	0.509	<2.2	<3.5	1.43	< 2.4
		6-2	3.48	0.738	36.1	1213	02/08(20)	0.548	4.8	12.6	2.14	5.9
		6-3	5.30	1.38	73.7	1304	02/15(18)	0.392	1,906	4,590	2.81	1,633
3.0	27	6-4	12.17	4.90	120	1281	02/15(03)	0.404	6,441	6,550	1.87	3,500
							Catfish Viscera					
1.4	26	7-1	19.3	6.23	180	1326	02/16(02)	0.385	4,310	2,900	1.63	1,779
		7-2	9.00	3.35	71.5	1333	02/16(05)	0.384	2,151	3,110	1.53	2,030
		7-3	12.4	4.95	127	1344	02/16(09)	0.380	1,119	1,187	2.51	473
3.0	25	8-1	8.66	3.26	72.4	1305	02/15(19)	0.391	1,403	2,070	1.49	1,389
		8-2	9.00	3.37	84.7	1249	02/14(16)	0.413	3,543	4,770	1.92	2,480
		8-3	12.0	3.67	115	1332	02/16(05)	0.384	5,175	5,620	1.52	3,530

B.1-1 (cont'd)

P-32 Uptake in Worm-fed Bluegill and Catfish
Maintained in Aquaria for Nine Days

Feed %/day	Temp, °C	Fish No.	Weight Wet	Weight Dry	Weight Ash	Sample No.	Counting date, 1983 (hr)	Decay fraction	Net c/min.	c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg
							Bluegill Scales and Skin					
0.87	11	1-1	15.3	5.66	1,900	1202	02/08(11)	0.558	1,265.	741	26.5	28.0
		1-2	10.4	4.15	1,417	1350	02/22(23)	0.276	73.6	128	29.3	4.37
		1-3	9.69	3.99	1,550	1265	02/14(21)	0.409	407.	513	32.3	15.9
1.6	23	2-1	7.19	2.96	1,040	1285	02/15(04)	0.403	491.	847	30.8	27.5
		2-2	7.76	3.12	1,200	1237	02/09(03)	0.540	16.2	19.3	30.7	0.63
		2-3	12.2	5.40	2,230	1330	02/16(04)	0.384	2,794	2,980	39.9	74.4
2.9	24	3-1	7.13	3.13	1,210	1266	02/14(22)	0.407	1,882	3,240	35.7	90.8
		3-2	10.5	4.37	1,910	1276	02/15(01)	0.406	345	415	35.5	11.7
		3-3	13.8	5.65	2,160	1264	02/14(21)	0.409	5,252	4,650	35.1	132.
1.5	27	4-1	7.32	2.98	1,230	1206	02/08(12)	0.505	770	1,041	38.6	27.0
		4-2	8.21	3.07	897	1278	02/15(02)	0.405	1,155	1,737	27.5	63.2
		4-3	11.4	4.91	2,050	1230	02/09(09)	0.534	2,151	1,767	34.4	51.4
2.4	27	5-1	8.02	3.28	1,430	1256	02/14(18)	0.411	1,805	2,720	36.3	74.9
		5-2	10.4	4.19	1,540	1223	02/08(15)	0.553	2,987	2,600	32.8	79.3
		5-3	15.4	6.73	2,890	1313	02/15(21)	0.390	1,908	1,588	41.7	38.1
2.9	25	6-1	7.63	2.59	917	1177	02/03(06)	0.512	24.7	31.6	26.2	1.21
		6-2	3.99	1.61	654	1236	02/09(01)	0.542	8.3	19.2	32.2	0.60
		6-3	9.94	4.46	1,757	1354	02/22(11)	0.283	1,084	1,927	35.2	54.7
		6-4	19.5	6.65	1,970	1290	02/15(06)	0.400	5,728	3,670	21.1	174.
							Catfish Skin					
1.4	27	7-1	20.5	6.62	176	1348	02/21(16)	0.294	1,031	855	1.47	582.
		7-2	8.89	2.46	56.2	1336	02/16(06)	0.383	519	762	1.11	686.
		7-3	6.98	2.16	60.1	1251	02/14(17)	0.412	209	363	1.38	263.
3.0	26	8-1	8.28	2.75	64.2	1334	02/16(05)	0.384	331	521	1.28	407.
		8-2	7.09	2.63	54.4	1311	02/15(21)	0.390	596	1,078	1.39	776.
		8-3	11.8	3.63	96.5	1359	02/22(13)	0.282	973	1,462	1.46	1,001.

B.1-1 (cont'd)

P-32 Uptake in Worm-fed Bluegill and Catfish
Maintained in Aquaria for Nine Days

Feed %/day	Temp, °C	Fish No.	Weight Wet	Weight Dry	Weight Ash	Sample No.	Counting date, 1983 (hr)	Decay fraction	Net c/min.	c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg
							Bluegill Head					
0.87	11	1-1	42.3	12.8	3,040	1199	02/08(10)	0.559	2,958	625	14.0	44.6
		1-2	33.5	10.1	2,600	1319	02/15(23)	0.388	193	74.2	14.8	5.01
		1-3	33.9	9.10	2,740	1254	02/14(18)	0.411	982	352	15.2	23.2
1.6	23	2-1	25.0	7.66	1,950	1329	02/16(04)	0.384	1,003.	522	15.7	33.2
		2-2	27.0	8.02	2,220	1204	02/08(01)	0.569	49.0	15.9	15.3	1.04
		2-3	53.4	16.9	4,790	1292	02/15(06)	0.400	7,266.	1,700	17.9	95.0
2.9	24	3-1	27.9	8.39	2,280	1267	02/14(22)	0.407	3,836	1,689	15.6	108.
		3-2	33.2	8.07	3,200	1247	02/14(12)	0.416	720	261	18.7	14.0
		3-3	50.4	15.7	3,830	1227	02/08(16)	0.552	11,910	2,140	14.4	149.
1.5	27	4-1	36.1	9.27	2,960	1205	02/08(11)	0.506	1,755	480	16.3	29.4
		4-2	27.0	7.59	1,990	1229	02/09(08)	0.535	3,258	1,128	13.0	86.8
		4-3	44.0	14.3	3,430	1226	02/08(16)	0.554	4,409	904	13.5	67.0
2.4	27	5-1	33.5	8.64	2,630	1253	02/14(17)	0.412	3,571	1,294	15.5	83.5
		5-2	38.2	11.6	3,090	1228	02/09(08)	0.535	6,454	1,579	15.5	102.
		5-3	47.8	14.9	4,540	1324	02/16(01)	0.386	2,854	773	19.0	40.7
2.9	25	6-1	28.5	6.98	2,210	1175	02/03(03)	0.515	48.4	16.5	14.9	1.11
		6-2	20.0	5.09	1,560	1238	02/09(04)	0.539	17.7	8.2	15.6	0.53
		6-3	32.1	10.1	3,030	1325	02/16(01)	0.386	2,428	980	19.2	51.0
		6-4	50.3	15.3	3,280	1288	02/15(05)	0.402	10,480	2,590	12.2	212.
							Catfish Head					
1.4	27	7-1	65.1	21.3	4,430	1351	02/22(10)	0.279	5,591	1,539	13.2	117.
		7-2	43.7	12.9	2,430	1322	02/15(24)	0.387	7,503	2,220	11.6	191.
		7-3	40.7	13.2	2,650	1357	02/22(12)	0.277	2,121	941	11.8	79.7
3.0	26	8-1	45.1	13.9	2,740	1320	02/15(24)	0.387	3,460	991	12.0	82.6
		8-2	44.0	14.3	2,590	1355	02/22(12)	0.277	5,937	2,440	11.5	212.
		8-3	47.3	13.9	2,760	1246	02/14(12)	0.416	13,240	3,360	11.3	297.

B.1-1 (cont'd)

P-32 Uptake in Worm-fed Bluegill and Catfish
Maintained in Aquaria for Nine Days

Feed %/day	Temp, °C	Fish No.	Weight Wet	Weight Dry	Weight Ash	Sample No.	Counting date, 1983 (hr)	Decay fraction	Net c/min.	c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg
							Bluegill Gills					
0.87	11	1-1	0.540	0.101	7.0	1210	02/08(06)	0.564	133.	2,180	3.62	602
		1-2	0.237	0.046	4.3	1338	02/16(15)	0.375	6.5	366	4.38	83.6
		1-3	0.485	0.087	6.1	1346	02/22(18)	0.279	40.6	1,500	3.45	435
1.6	23	2-1	0.502	0.079	0.5	1297	02/16(12)	0.378	54.6	1,439	3.10	464.
		2-2	0.502	0.129	3.7	1211	02/08(18)	0.550	4.8	86.9	2.66	32.7
		2-3	0.672	0.114	8.9	1302	02/15(18)	0.392	154.	2,920	3.00	973
2.9	24	3-1	0.425	0.079	5.6	1303	02/15(18)	0.392	112.	3,360	3.87	868
		3-2	0.574	0.071	6.5	1358	02/22(23)	0.295	14.6	431	1.83	236
		3-3	0.692	0.122	9.7	1269	02/14(23)	0.407	232.	4,120	3.53	1,167
1.5	27	4-1	0.653	0.059	2.7	1208	02/08(03)	0.515	48.4	720	1.59	453
		4-2	0.304	0.043	2.4	1268	02/14(22)	0.408	76.2	3,070	3.17	968
		4-3	0.560	0.103	6.7	1231	02/09(09)	0.534	136.	2,270	3.14	723
2.4	27	5-1	0.773	0.094	12.0	1347	02/22(20)	0.278	62.4	1,452	3.49	416
		5-2	0.742	0.129	9.7	1233	02/09(10)	0.533	342.	4,320	3.30	1,309
		5-3	0.703	0.134	9.8	1295	02/15(15)	0.394	310.	5,600	4.01	1,397
2.9	25	6-1	0.534	0.076	10.9	1179	02/03(10)	0.507	4.1	75.7	4.30	17.6
		6-2	0.269	0.042	5.4	1209	02/08(04)	0.566	2.4	78.8	4.96	15.9
		6-3	0.530	0.089	5.8	1310	02/15(20)	0.391	120.	2,900	3.36	863
		6-4	0.850	0.091	8.8	1280	02/15(02)	0.405	348.	5,050	2.27	2,220.
							Catfish Gills					
1.4	27	7-1	1.24	1.24	16.6	1293	02/15(07)	0.400	251.	2,530	3.25	778
		7-2	0.951	0.188	10.3	1294	02/15(07)	0.400	216.	2,840	3.43	828
		7-3	1.09	0.220	14.0	1270	02/14(23)	0.407	103.	1,161	3.05	381
3.0	26	8-1	1.22	0.238	14.7	1349	02/22(21)	0.277	95.8	1,417	2.66	533
		8-2	0.828	0.164	10.6	1250	02/14(16)	0.413	246.	3,600	3.49	1,032
		8-3	1.08	0.215	12.5	1309	02/15(20)	0.391	335.	3,970	3.29	1,207

B.1-1 (cont'd)

P-32 Uptake in Worm-fed Bluegill and Catfish
Maintained in Aquaria for Nine Days

Feed %/day	Temp, °C	Fish No.	Weight Wet	Weight Dry	Weight Ash	Sample No.	Counting date, 1983 (hr)	Decay fraction	Net c/min.	c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg
Catfish Fin Spines												
1.5	25	7-1	0.712	0.494	261	1296	02/15(16)	0.393	291.	5,200	82.4	63.1
1.5	25	7-2	0.395	0.251	129	1300	02/15(17)	0.392	212.	6,850	81.0	84.6
1.5	25	7-3	0.451	0.302	151	1335	02/16(06)	0.382	105.	3,050	75.6	40.3
3.0	25	8-1	0.493	0.312	168	1306	02/15(19)	0.391	122.	3,160	48.1	65.7
3.0	25	8-2	0.363	0.226	118	1271	02/14(23)	0.407	245.	8,290	62.1	133
3.0	25	8-3	0.390	0.254	126	1301	02/15(17)	0.392	244.	7,980	74.1	108
Catfish Fins												
1.5	25	7-1	8.41	3.33	370	1327	02/16(02)	0.385	1,226	1,893	9.21	206
1.5	25	7-2	4.73	1.52	170	1312	02/15(21)	0.388	833	2,270	8.19	277
1.5	25	7-3	4.17	1.63	206	1328	02/16(02)	0.385	365	1,137	13.3	85.5
3.0	25	8-1	5.50	2.08	252	1307	02/15(19)	0.390	563	1,312	10.1	130
3.0	25	8-2	4.13	1.64	214	1252	02/14(17)	0.412	1,147	3,370	11.7	288
3.0	25	8-3	4.15	1.38	165	1308	02/15(20)	0.390	931	2,880	8.01	360

B.1-2
P-32 Uptake in Pellet-fed Bluegill and Catfish
Maintained in Aquaria for Nine Days

Feed %/day	Temp, °C	Fish No.	Weight Wet	Weight Dry	Weight Ash	Sample No.	Counting date, 1983(hr)	Decay fraction	Net c/min.	c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg
							Catfish Muscle					
0.41	11	1-1	51.9	11.0	617	1527	03/14(18)	0.293	953.	313.	2.65	118.
		1-2	44.7	10.4	506	1430	03/04(19)	0.475	23.6	5.6	2.15	2.6
		1-3	51.0	12.3	580	1530	03/12(09)	0.329	28.2	8.4	1.19	7.1
0.48	20	3-1	51.2	12.2	569	1503	03/09(04)	0.384	36.4	9.3	2.21	4.2
		3-2	33.0	7.22	350	1458	03/05(17)	0.454	15.4	5.1	2.19	2.3
		3-3	49.0	11.4	575	1372	02/25(20)	0.665	31.1	4.8	2.41	2.0
0.62	20	4-1	51.0	11.6	579	1477	03/09(09)	0.380	16,161	4,170	2.40	1,738.
		4-2	45.5	10.2	528	1386	02/28(08)	0.589	16,270	3,036	2.60	1,168
		4-3	53.3	12.0	590	1531	03/14(19)	0.292	9,049.	2,907	2.37	1,227
0.88	20	5-1	52.4	11.7	590	1524	03/14(17)	0.293	2,814	916	2.32	395
		5-2	41.3	9.67	463	1433	03/07(14)	0.415	6,500	1,896	2.43	780
		5-3	41.8	9.62	470	1529	03/14(19)	0.292	2,221	910	2.33	391
0.34	24	7-1	54.9	12.6	625	1508	03/09(17)	0.374	13,474	3,281	2.34	1,402
		7-2	63.7	13.7	744	1525	03/14(18)	0.293	5,149	1,379	2.29	602
		7-3	64.3	15.3	734	1523	03/14(17)	0.293	18,954	5,030	2.30	2,187
0.80	24	8-1	51.6	12.3	564	1528	03/14(19)	0.292	7,897	2,621	2.27	1,155
		8-2	40.4	9.14	449	1526	03/14(18)	0.293	3,026	1,278	2.08	614
		8-3	42.6	9.96	464	1381	02/28(09)	0.588	6,881	1,374	2.27	605
							Bluegill Muscle					
0.41	20	2-1	27.4	6.21	342	1456	03/07(17)	0.412	8,326	3,688	4.02(4)	917
		2-2	17.4	3.55	201	1455	03/05(15)	0.456	54.1	34.1	2.60	13.1
		2-3	36.2	7.81	455	1457	03/07(18)	0.411	7,620	2,561	2.51	1,020
0.79	19	6-1	21.6	4.40	259	1459	03/05(18)	0.453	171	87.3	2.16	40.4
		6-2	27.5	5.05	303	1532	03/12(11)	0.327	27.4	15.2	2.37	6.4
		6-3	33.3	7.20	424	1460	03/07(18)	0.411	18,270	6,675	2.45	2,724

1) Exposure period was 02/08 - 02/17(10). 2) Wet and dry weights are in grams; ash weight is in mg. 3) Duplicate 20-ml aliquots of 100-ml samples were analyzed for P-32 by Cherenkov counting with 50-min counts when < 200 c/min and 10-min counts when > 200 c/min. 4) Weight appears to be erroneous

B.1-2 (cont'd)
P-32 Uptake in Pellet-fed Catfish and Bluegill
Maintained in Aquaria for Nine Days

Feed %/day	Temp, °C	Fish No.	Weight Wet	Dry	Ash	Sample No.	Counting date, 1983(hr)	Decay fraction	Net c/min.	c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg
Catfish Skeleton												
0.41	11	1-1	26.0	7.25	1,060	1559	03/15(01)	0.289	630.	419.	8.66	48.4
		1-2	26.0	7.89	937	1383	02/25(21)	0.664	17.5	5.1	6.33	0.805
		1-3	22.3	7.49	922	1551	03/12(21)	0.319	11.9	8.4	8.25	1.02
0.48	20	3-1	23.8	7.69	887	1485	03/08(17)	0.393	17.0	9.1	7.76	1.17
		3-2	26.5	7.76	844	1490	03/08(20)	0.390	18.6	9.0	6.60	1.36
		3-3	19.7	5.91	804	1435	03/04(21)	0.473	14.8	7.9	8.75	0.903
0.62	20	4-1	24.8	8.01	996	1489	03/09(13)	0.377	7,907	4,229	7.26	583
		4-2	20.7	6.09	762	1434	03/07(14)	0.415	6,273	3,651	6.72	543
		4-3	27.9	8.23	810	1566	03/15(03)	0.287	5,389	3,365	5.81	579
0.88	20	5-1	21.7	6.41	847	1486	03/09(12)	0.378	1,954	1,191	7.27	164
		5-2	18.2	5.69	736	1432	03/07(13)	0.415	3,824	2,531	6.90	367
		5-3	24.8	7.54	825	1555	03/14(24)	0.289	1,549	1,081	6.50	166
0.34	24	7-1	33.5	10.2	1,010	1484	03/09(11)	0.379	11,989	4,721	5.90	800
		7-2	40.8	11.2	1,741	1534	03/14(20)	0.292	4,218	1,770	8.65	205
		7-3	26.2	8.12	985	1561	03/15(02)	0.288	10,394	6,887	7.34	938
0.80	24	8-1	25.7	8.61	857	1556	03/15(01)	0.289	4,448	2,994	6.95	431
		8-2	20.3	6.04	730	1567	03/15(04)	0.287	1,606	1,378	6.69	206
		8-3	29.8	9.07	997	1431	03/07(13)	0.415	4,285	1,732	6.39	271
Bluegill Skeleton												
0.41	20	2-1	15.1	5.31	1,420	1475	03/09(09)	0.380	5,948	4,748	18.8	252
		2-2	17.4	5.19	1,670	1492	03/08(22)	0.389	135	99.7	18.1	5.51
		2-3	21.1	6.76	1,800	1506	03/09(16)	0.375	10,305	6,512	13.4	486
0.79	19	6-1	15.4	4.87	1,480	1504	03/09(16)	0.375	251.	217	18.9	11.5
		6-2	17.4	5.42	1,730	1554	03/12(24)	0.319	56.2	50.6	18.4	2.75
		6-3	18.7	6.22	1,750	1509	03/09(17)	0.374	15,037	10,750	17.3	621

B.1-2 (cont'd)
P-32 Uptake in Pellet-fed Catfish and Bluegill
Maintained in Aquaria for Nine Days

Feed %/day	Temp, °C	Fish No.	Weight Wet	Weight Dry	Weight Ash	Sample No.	Counting date, 1983(hr)	Decay fraction	Net c/min.	c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg
							Catfish Viscera					
0.41	11	1-1	12.0	2.52	140	1536	03/14(20)	0.292	5,052	7,208	2.26	3,190
		1-2	11.0	3.38	101	1418	02/27(13)	0.612	32.1	23.8	1.96	12.1
		1-3	14.8	6.13	111	1498	03/09(01)	0.386	42.8	37.5	1.77	21.2
0.48	20	3-1	10.8	3.86	86.6	1446	03/05(05)	0.465	14.4	14.3	1.60	8.9
		3-2	6.53	1.80	54.9	1454	03/05(13)	0.458	6.6	11.0	1.63	6.7
		3-3	9.49	3.47	74.4	1416	02/27(10)	0.616	41.1	35.2	1.57	22.4
0.62	20	4-1	13.9	4.08	142	1550	03/14(24)	0.289	7,828	9,743	1.87	5,210
		4-2	12.0	4.17	123	1448	03/07(17)	0.412	6,837	6,914	1.59	4,350
		4-3	16.3	4.67	178	1515	03/09(19)	0.373	8,021	6,596	2.21	2,990
0.88	20	5-1	11.8	3.63	123	1499	03/09(15)	0.376	2,231	2,514	2.60	965
		5-2	14.2	4.22	159	1420	02/27(18)	0.606	13,271	7,711	1.94	3,970
		5-3	15.5	5.04	166	1537	03/14(21)	0.291	4,520	5,011	2.05	2,440
0.34	24	7-1	12.8	3.04	125	1544	03/14(22)	0.291	5,953	7,991	1.63	4,900
		7-2	11.4	2.44	119	1514	03/09(19)	0.373	5,866	6,898	1.74	3,970
		7-3	22.3	7.77	272	1463	03/07(19)	0.410	16,488	9,017	2.61	3,460
0.80	24	8-1	15.1	6.17	120	1470	03/07(21)	0.409	4,818	3,901	1.32	2,950
		8-2	8.69	2.47	93.4	1548	03/14(23)	0.290	2,925	5,803	1.96	2,960
		8-3	13.2	3.96	146	1414	02/28(13)	0.583	8,330	5,412	2.24	2,420
							Bluegill Viscera					
0.41	20	2-1	7.22	2.02	96.7	1465	03/07(19)	0.410	10,098	17,060	2.10	8,120
		2-2	3.45	0.624	42.0	1467	03/05(22)	0.450	301	969	2.20	440
		2-3	13.0	3.40	201	1469	03/07(20)	0.410	22,769	21,360	2.51	8,510
0.79	19	6-1	4.19	0.911	56.5	1462	03/07(18)	0.411	1,220	3,542	2.27	1,559
		6-2	4.40	0.869	48.7	1427	03/04(16)	0.478	198	471	2.33	202
		6-3	10.9	3.12	169	1468	03/07(20)	0.410	20,648	23,100	2.58	8,950

B.1-2 (cont'd)
P-32 Uptake in Pellet-fed Catfish and Bluegill
Maintained in Aquaria for Nine Days

Feed %/day	Temp, °C	Fish No.	Weight Wet	Dry	Ash	Sample No.	Counting date, 1983(hr)	Decay fraction	Net c/min.	c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg
							Catfish Skin					
0.41	11	1-1	10.5	2.72	89.1	1535	03/14(20)	0.292	293	478	1.71	280
		1-2	9.16	2.88	70.3	1415	02/27(09)	0.617	19.4	17.1	1.37	12.5
		1-3	10.0	3.16	77.0	1443	03/04(24)	0.470	12.2	13.0	1.58	8.23
0.48	20	3-1	12.7	4.60	107	1403	02/26(22)	0.631	29.0	18.1	1.73	10.5
		3-2	7.24	2.20	55.9	1406	02/26(24)	0.629	12.0	13.2	1.42	9.30
		3-3	10.1	3.60	72.7	1417	02/27(12)	0.613	8.9	7.2	1.45	4.97
0.62	20	4-1	8.94	2.76	63.8	1542	03/14(22)	0.291	1,124	2,160	1.21	1,785.
		4-2	8.05	2.41	62.7	1402	02/28(11)	0.586	1,763	1,869	1.47	1,271.
		4-3	8.58	2.57	65.6	1500	03/09(15)	0.375	1,171	1,820	1.51	1,205.
0.88	20	5-1	12.1	3.68	103	1413	02/28(12)	0.584	1,025	725	1.57	462.
		5-2	8.25	2.71	62.2	1411	02/28(12)	0.584	1,325	1,375	1.56	881.
		5-3	7.90	2.84	56.6	1543	03/14(22)	0.291	267	581	1.31	444.
0.34	24	7-1	9.04	2.77	66.5	1520	03/14(16)	0.294	1,127	2,120	1.28	1,656.
		7-2	9.82	2.79	76.1	1495	03/09(14)	0.376	782	1,060	1.47	721.
		7-3	9.46	3.12	68.0	1471	03/09(08)	0.381	2,048	2,841	1.23	2,310.
0.80	24	8-1	9.42	3.23	67.7	1464	03/07(19)	0.410	1,251	1,620	1.30	1,246
		8-2	8.76	2.73	70.7	1472	03/09(08)	0.381	611	915	1.60	572
		8-3	8.32	2.71	65.6	1408	02/28(12)	0.585	1,027	1,055	1.33	793
							Bluegill Scales and Skin					
0.41	20	2-1	7.54	3.25	1,130	1511	03/09(18)	0.373	2,982	5,300	32.1	165.
		2-2	8.26	3.15	1,890	1474	03/08(11)	0.397	111	169	28.3	5.97
		2-3	7.32	2.99	1,090	1478	03/09(10)	0.379	6,389	11,510	32.7	352.
0.79	19	6-1	5.91	2.79	1,110	1479	03/08(13)	0.396	168	359	40.8	8.80
		6-2	8.61	3.44	1,320	1557	03/13(02)	0.317	19.2	35.2	31.9	1.10
		6-3	7.54	3.32	1,230	1510	03/09(18)	0.373	8,682	15,440	35.1	440.

B.1-2 (cont'd)
P-32 Uptake in Pellet-fed Catfish and Bluegill
Maintained in Aquaria for Nine Days

Feed %/day	Temp, °C	Fish No.	Weight Wet	Dry	Ash	Sample No.	Counting date, 1983(hr)	Decay fraction	Net c/min.	c/min.g. wet	P, mg/g wet	P/32/P, c/min.mg
							Catfish Head					
0.41	11	1-1	48.5	14.2	4,080	1564	03/15(03)	0.287	1,277	459	16.2	28.3
		1-2	44.5	13.0	2,640	1384	02/25(23)	0.661	33.3	5.7	11.2	0.51
		1-3	39.7	12.6	2,600	1552	03/12(23)	0.319	21.9	8.6	12.7	0.68
0.48	20	3-1	40.2	12.8	2,610	1487	03/08(18)	0.392	30.4	9.6	12.8	0.75
		3-2	34.0	9.51	1,860	1533	03/12(13)	0.326	30.6	13.8	10.0	1.38
		3-3	40.8	12.8	2,820	1385	02/26(01)	0.658	27.7	5.2	13.1	0.40
0.62	20	4-1	43.7	13.3	2,860	1491	03/09(13)	0.377	14,902	4,522	13.4	337.
		4-2	37.7	11.2	2,320	1436	03/07(14)	0.414	14,027	4,494	12.2	368.
		4-3	44.6	13.0	2,380	1553	03/14(24)	0.289	8,835	3,427	10.3	333.
0.88	20	5-1	36.9	11.0	2,480	1493	03/09(13)	0.377	3,626	1,303	13.2	98.7
		5-2	33.9	10.8	2,270	1437	03/07(15)	0.414	8,313	2,962	12.6	235.
		5-3	38.7	12.0	2,390	1562	03/15(02)	0.288	2,576	1,156	12.1	95.5
0.34	24	7-1	52.9	14.1	2,880	1502	03/09(15)	0.375	23,891	6,022	10.6	568
		7-2	66.1	19.3	5,530	1488	03/09(12)	0.378	9,751	1,951	17.2	113
		7-3	43.7	13.1	2,776	1560	03/15(01)	0.289	18,723	7,412	11.5	644
0.80	24	8-1	54.9	16.9	3,019	1565	03/15(03)	0.287	9,077	2,880	10.4	277
		8-2	41.1	12.5	2,652	1563	03/15(02)	0.288	3,242	1,369	12.9	106
		8-3	38.9	12.5	2,440	1438	03/07(15)	0.414	7,258	2,253	12.6	179
							Bluegill Head					
0.41	20	2-1	25.4	8.21	1,970	1505	03/09(16)	0.375	7,221	3,791	13.8	275.
		2-2	27.9	7.58	2,360	1480	03/08(15)	0.394	215	97.8	16.3	6.00
		2-3	31.9	9.41	2,300	1507	03/09(17)	0.374	12,991	5,444	13.7	397.
0.79	19	6-1	24.3	7.31	1,990	1461	03/05(20)	0.451	344	157	15.5	10.1
		6-2	23.5	7.07	2,050	1558	03/13(04)	0.316	47.4	31.9	16.0	1.99
		6-3	30.4	9.02	2,290	1476	03/09(09)	0.380	20,188	8,738	14.0	624.

B.1-2 (cont'd)
P-32 Uptake in Pellet-fed Catfish and Bluegill
Maintained in Aquaria for Nine Days

Feed %/day	Temp, °C	Fish No.	Weight Wet	Dry	Ash	Sample No.	Counting date, 1983(hr)	Decay fraction	Net c/min.	c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg
							Catfish Gills					
0.41	11	1-1	1.08	0.194	13.4	1540	03/12(16)	0.324	83.5	1,193	2.91	410
		1-2	1.09	0.175	12.2	1396	02/26(17)	0.637	<2.1	<15	2.79	< 5
		1-3	0.975	0.177	11.5	1393	02/26(12)	0.644	3.9	31.1	3.01	10.3
0.48	20	3-1	1.34	0.237	16.3	1392	02/26(11)	0.645	4.0	23.1	2.89	8.0
		3-2	1.27	0.214	14.5	1387	02/26(02)	0.657	3.7	22.2	2.71	8.2
		3-3	0.985	0.173	11.4	1378	02/25(18)	0.668	5.1	38.8	3.49	11.1
0.62	20	4-1	0.989	0.182	11.5	1541	03/14(21)	0.291	344	5,980	2.83	2,110.
		4-2	0.758	0.132	9.0	1421	03/07(11)	0.417	274	4,330	2.64	1,640
		4-3	0.885	0.143	8.9	1513	03/09(19)	0.372	309	4,690	2.98	1,574
0.88	20	5-1	0.814	0.145	9.2	1389	02/26(06)	0.652	213	2,010	2.97	677
		5-2	0.752	0.139	8.2	1419	02/27(16)	0.609	329	3,590	3.05	1,177
		5-3	1.04	0.179	20.5	1539	03/12(14)	0.325	100	1,479	2.88	514
0.34	24	7-1	1.11	0.187	9.2	1517	03/09(20)	0.372	721	8,730	2.67	3,270
		7-2	1.56	0.261	16.7	1512	03/09(18)	0.373	576	4,950	2.55	1,941
		7-3	0.856	0.160	9.8	1424	03/07(12)	0.416	824	11,570	3.03	3,820
0.80	24	8-1	1.52	0.202	12.1	1516	03/09(20)	0.372	435	3,850	2.33	1,652
		8-2	0.695	0.128	11.0	1444	03/04(24)	0.470	212	3,240	3.33	973
		8-3	1.11	0.196	12.2	1405	02/28(11)	0.586	564	4,340	2.87	1,512
							Bluegill Gills					
0.41	20	2-1	0.539	0.101	6.3	1452	03/05(10)	0.460	678	13,670	3.46	3,950
		2-2	0.406	0.060	3.9	1451	03/05(08)	0.462	10.8	288	2.81	102
		2-3	0.782	0.143	10.4	1450	03/07(17)	0.412	648	10,060	3.35	3,000
0.79	19	6-1	0.344	0.063	3.7	1453	03/05(12)	0.459	19.8	627	3.88	162.
		6-2	0.436	0.080	5.9	1521	03/12(07)	0.330	3.0	104	5.30(4)	19.6
		6-3	0.667	0.122	8.6	1426	03/07(12)	0.416	824	14,850	3.44	4,320.

B.1-2 (cont'd)
P-32 Uptake in Pellet-fed Catfish and Bluegill
Maintained in Aquaria for Nine Days

Feed %/day	Temp, °C	Fish No.	Weight Wet	Dry	Ash	Sample No.	Counting date, 1983(hr)	Decay fraction	Net c/min.	c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg
							Catfish Fins					
0.41	11	1-1	5.22	1.59	270	1545	03/12(18)	0.322	349	1,038	10.6	97.9
		1-2	5.10	1.97	223	1412	02/27(07)	0.620	8.1	12.8	10.5	1.22
		1-3	3.90	1.42	187	1409	02/27(04)	0.623	7.7	15.8	9.59	1.65
0.48	20	3-1	3.73	1.39	181	1404	02/26(24)	0.629	8.5	18.1	9.43	1.92
		3-2	4.34	1.59	190	1445	03/05(04)	0.466	<2.1	<5	8.72	< 0.6
		3-3	3.94	1.43	196	1449	03/05(07)	0.463	3.5	9.6	9.45	1.02
0.62	20	4-1	4.71	1.57	199	1549	03/14(23)	0.290	1,306	4,781	9.07	527.
		4-2	3.82	1.25	162	1447	03/07(16)	0.413	1,285	4,072	8.51	478.
		4-3	5.18	1.69	204	1497	03/09(14)	0.376	1,494	3,835	8.79	436
0.88	20	5-1	4.85	1.61	204	1439	03/04(22)	0.472	653	1,426	8.53	167
		5-2	3.15	1.18	149	1429	03/07(13)	0.415	766	2,930	11.4	257
		5-3	4.15	1.46	198	1546	03/12(19)	0.322	382	1,428	9.69	147
0.34	24	7-1	5.85	1.79	227	1538	03/14(21)	0.291	2,021	5,936	7.86	755
		7-2	8.13	2.50	400	1446	03/05(05)	0.465	14.4	19.0	2.56(4)	7.42
		7-3	4.35	1.48	188	1466	03/07(20)	0.409	3,039	8,541	9.17	931
0.80	24	8-1	4.68	1.67	202	1547	03/14(3)	0.290	1,051	3,872	8.94	433
		8-2	4.32	1.58	212	1473	03/09(08)	0.381	567	1,722	11.7	147
		8-3	4.86	1.82	208	1407	02/28(11)	0.586	1,296	2,275	8.85	257

B.1-2 (cont'd)
P-32 Uptake in Pellet-fed Catfish and Bluegill
Maintained in Aquaria for Nine Days

Feed %/day	Temp, °C	Fish No.	Weight Wet	Dry	Ash	Sample No.	Counting date, 1983(hr)	Decay fraction	Net c/min.	c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg
							Catfish Fin Spines					
0.41	11	1-1	0.778	0.471	280	1519	03/12(06)	0.331	62.0	1,204	73.0	16.5
		1-2	0.453	0.226	120	1388	02/26(04)	0.654	2.1	35.4	57.3	0.62
		1-3	0.390	0.211	114	1428	03/04(17)	0.477	3.2	86.0	57.8	1.49
0.48	20	3-1	0.426	0.247	128	1397	02/26(19)	0.635	2.5	46.2	62.3	0.74
		3-2	0.373	0.198	107	1391	02/26(09)	0.648	<2.1	<43	38.1	< 1
		3-3	0.434	0.249	134	1394	02/26(14)	0.641	<2.1	<31	60.4	< 0.6
0.62	20	4-1	0.427	0.223	116	1518	03/09(20)	0.372	292	9;190	64.2	143
		4-2	0.363	0.202	111	1399	02/28(10)	0.587	413	9,690	59.2	164
		4-3	0.388	0.189	95.2	1494	03/08(23)	0.388	210	6,980	60.0	116
0.88	20	5-1	0.383	0.219	122	1395	02/26(16)	0.639	135	2,760	68.1	40.5
		5-2	0.421		93.5	1390	02/26(07)	0.650	233	4,260	44.7	95.3
		5-3	0.388	0.196	100	1398	02/26(21)	0.632	124	2,530	58.1	43.5
0.34	24	7-1	0.491	0.229	116	1522	03/14(17)	0.294	417	14,440	52.2	277
		7-2	0.780	0.474	293	1501	03/09(03)	0.385	169	2,810	75.0	37.5
		7-3	0.413	0.231	123	1425	03/07(12)	0.416	750	21,830	56.7	385
0.80	24	8-1	0.421	0.210	113	1422	03/07(11)	0.417	321	9,140	60.5	151
		8-2	0.393	0.218	121	1423	03/04(14)	0.479	113	3,000	64.5	46.5
		8-3	0.447	0.227	119	1410	02/27(05)	0.622	246	4,420	58.4	75.7

B.2-1

P-32 Concentration in Worms Fed to Bluegill & Catfish in Aquaria

Feeding Date, 1983	Amount fed, g	Vial No.	Weight, mg Dry	Ash	No. of worms	Counting date, 1983 (hr)	Decay factor	P-32 net c/min.	c/min g wet	P, mg/g wet wt.	P-32/P, c/min.mg.
01/18	64.5	1360	207	14.6	4	02/22(13)	0.182	356	4,890	0.90	5,464
		1361	263	16.2	8	02/22(13)	0.182	759	10,430	1.13	9,230
01/19	62.8	1362	297	18.7	8	02/22(14)	0.191	2,298	30,080	1.23	24,455
		1363	295	18.8	6	02/22(14)	0.191	2,173	28,440	1.23	23,122
01/20	67.0	1364	264	16.2	8	02/22(14)	0.200	1,500	18,750	1.10	17,045
		1365	318	18.4	8	02/22(15)	0.200	1,571	19,640	1.27	15,465
01/21	71.5	1366	259	15.2	6	02/22(15)	0.210	1,885	22,440	1.00	22,440
		1367	335	18.5	9	02/22(15)	0.210	1,979	23,560	1.38	17,072
01/22	64.2	1368	285	16.4	9	02/22(16)	0.220	2,441	27,740	1.23	22,553
		1369	267	13.5	6	02/22(16)	0.220	1,566	17,800	1.03	17,282
01/23	61.2	1370	256	15.8	9	02/23(07)	0.224	1,194	13,330	1.06	12,575
01/24	68.5	1371	251	14.0	11	02/23(07)	0.235	1,385	14,730	1.00	14,730
01/25	68.5	1372	271	14.8	5	02/23(08)	0.246	1,900	19,310	1.11	17,396
		1373	315	18.6	9	02/23(08)	0.246	2,233	22,690	1.25	18,152
01/26	68.5	1374	272	14.7	8	02/23(08)	0.258	1,541	14,930	1.12	13,330
		1375	310	16.3	8	02/23(09)	0.258	1,812	17,560	1.34	13,104
Average (± standard deviation of mean)										1.15 ± 0.03	16,500 ± 1,300

Notes: 1) Feed samples were 2 g moist weight; 20-ml aliquots of 100-ml samples were counted.
2) Amount fed is moist weight; amount of feed was based on fish weight.
3) P-32 added to worm feed was 3.21×10^5 c/min.g worm wet weight

P-32 Concentration in Pellets Fed to Bluegill & Catfish in Aquaria

Feeding Date, 1983	Amount fed, g	Vial No.	Weight, mg		Counting date, 1983 (hr)	Decay factor	P-32		P, mg/g wet wt.	P-32/P, c/min.mg
			Dry	Ash			net c/min.	c/min. g wet		
02/08	12.3	1568	545	58.5	03/18(10)	0.159	5,053	291,600	13.3	21,900
		1569	579	60.9	03/18(11)	0.158	5,545	301,400	12.9	23,400
02/09	12.3	1570	477	51.2	03/18(11)	0.166	4,856	306,700	13.6	22,600
		1571	561	59.6	03/18(11)	0.166	5,546	297,700	13.5	22,100
02/10	12.3	1572	565	53.8	03/18(12)	0.174	5,934	301,800	14.0	21,600
		1573	638	68.0	03/18(12)	0.174	6,258	281,900	14.8	19,000
02/11	12.3	1574	535	53.8	03/18(12)	0.183	5,699	291,000	13.2	22,000
		1575	608	64.3	03/18(13)	0.182	6,770	305,900	14.2	21,500
02/12	12.3	1576	563	58.5	03/18(13)	0.191	6,615	307,600	13.9	22,100
		1577	665	68.6	03/18(13)	0.191	7,395	291,100	14.1	20,600
02/13	12.3	1578	491	51.4	03/18(14)	0.200	6,048	307,900	14.2	21,700
		1579	422	45.2	03/18(14)	0.200	5,255	311,400	13.9	32,400
02/14	24.5	1580	426	44.8	03/18(14)	0.210	5,409	302,300	12.1	25,000
		1581	689	74.7	03/18(15)	0.210	8,723	301,500	13.0	23,000
02/15	37.0	1582	588	58.5	03/18(15)	0.220	7,626	294,700	29.8	21,800
		1583	660	69.1	03/18(15)	0.220	8,601	296,200	15.7	18,900
02/16	37.0	1584	603	61.5	03/18(16)	0.231	8,413	302,000	12.9	23,400
		1585	721	73.2	03/18(16)	0.231	9,733	292,200	13.5	21,600
Average (± standard deviation of mean)									13.7 ± 0.2	21,900 ± 350

Notes: 1. Feed samples were dry weight as shown; 20-ml aliquots of 100-ml samples were counted.

2. Amount fed is dry weight; amount of feed was based on fish weight.

3. P-32 added was 3.36 x 10^5 c/min.g pellet.

B.3-1

P-32 in Aquarium Water During 9-day Studies of Worm-fed Bluegill and Catfish

Aquarium No.	Feed, g	Vial No.	Counting date, 1983 (hr)	Decay factor	P-32 net c/min.	P-32 c/min.L	P-32 water/feed	P, mg/L	P-32/P, c/min.mg
1	3.2	1193	02/04(17)	0.644	848	823	0.91	0.31	2,540
2	5.5	1194	02/04(18)	0.643	572	556	0.36	0.36	1,540
3	10.6	1217	02/08(13)	0.535	1,064	1,243	0.41	0.46	2,700
4	5.3	1218	02/08(14)	0.534	553	674	0.45	0.39	1,730
5	9.2	1239	02/09(11)	0.512	1,105	1,349	0.51	----	---
		1258	02/14(19)	0.395	821	1,299		0.47	6,440
6	10.1	1259	02/14(19)	0.395	911	1,441	0.50	0.49	2,940
7	8.4	1260	02/14(20)	0.394	153	243	0.10	0.22	1,100
		1282	02/15(03)	0.389	156	251		0.25	1,000
8	14.0	1283	02/15(03)	0.389	411	660	0.17	0.24	2,750

Notes: 1) 4-l samples of 70 l water in each aquarium were collected at daily water change on 01/26(15); samples were filtered with a 75-μ mesh and processed to 50 ml volumes.
2) Samples are 20-ml aliquots of 50 ml.
3) c/min in feed is 1.2 mg/g x 16,500 c/min.mg x g in column 2.

P-32 in Aquarium Water During 9-day Studies of
Pellet-fed Bluegill and Catfish

Aquarium No.	Feed, g	Vial No.	Counting date, 1983 (hr)	Decay factor	P-32 net c/min.	P-32 c/min.L	P-32 water/feed	P, mg/L	P-32/P, c/min.mg
1	3.6	1379	02/28(08)	0.567	13,320	14,680	0.95	0.77	19,100
2	2.4	1380	02/28(09)	0.566	3,118	3,440	0.34	0.46	7,480
3	3.8	1400	02/28(10)	0.565	9,257	10,240	0.63	0.79	13,000
4	5.4	1401	02/28(10)	0.565	7,969	8,820	0.38	0.62	14,200
5	7.0	1440	03/07(15)	0.398	9,061	14,230	0.48	0.75	19,000
		1441	03/07(16)	0.397	9,316	14,670		0.78	18,800
6	4.1	1442	03/07(16)	0.397	5,192	8,174	0.47	0.54	15,100
7	3.8	1481	03/09(10)	0.365	1,826	3,127	0.20	0.60	5,210
		1482	03/09(10)	0.365	2,016	3,452		0.72	4,790
8	6.9	1483	03/09(11)	0.364	8,161	14,110	0.47	0.76	18,600
In		1376	02/23(01)	0.807	<2.1	<1.6	----	0.27	<6
		1377	02/23(02)	0.806	8.7	6.7		0.26	26

Notes: 1) 4-l samples of 70 l water in each aquarium were collected at daily water change on 02/16(15); samples were filtered with a 75-μ mesh and processed to 50 ml volumes.
2) Samples are 20-ml aliquots of 50 ml.
3) c/min in feed is 13.7 mg/g x 21,900 c/min.mg x g in column 2.

B.4-1
Fish Weights and Amount of Worms Fed in Aquaria

Tank No.	Fish No.	Comments(1)	Fish wt, g Start	Fish wt, g End	Weight gain, d^{-1}	Amount fed, g	Feeding ratio g/d. 100 g.wt.
	1-1	---	150.0	149.3	0.000		
1(B)	1-2	---	118.0	111.0	-0.007		
	1-3	---	107.0	107.9	0.001		
	Avg.				-0.002	28.8	0.87
	2-1	2	103.1	88.8	-0.017		
2(B)	2-2	3	107.6	91.2	-0.018		
	2-3	1 01/19-22	161.2	161.2	0.000		
	Avg.				-0.012	49.4	1.61
	3-1	---	99.3	91.0	-0.001		
3(B)	3-2	---	109.0	97.6	-0.012		
	3-3	1	167.0	172.8	0.004		
	Avg.				-0.003	95.4	2.93
	4-1	---	106.7	110.0	0.004		
4(B)	4-2	---	98.8	87.8	-0.013		
	4-3	1	154.3	147.6	-0.005		
	Avg.				-0.005	47.6	1.53
	5-1	2	129.3	111.7	-0.016		
5(B)	5-2	1	104.1	122.0	0.017		
	5-3	3 01/23-25	173.4	146.3	-0.019		
	Avg.				-0.006	82.8	2.42
	6-2	---	73.0	74.3	0.002		
6(B)	6-3	---	95.0	100.3	0.006		
	6-4	---	164.6	169.1	0.003		
	Avg.				0.004	91.1	2.94
	7-1		271.0	262.4	-0.004		
7(C)	7-2		160.0	152.5	-0.005		
	7-3		169.0	160.6	-0.006		
	Avg.				-0.005	75.5	1.45
	8-1		167.1	156.1	-0.008		
8(C)	8-2		155.0	147.6	-0.005		
	8-3		169.0	161.2	-0.005		
	Avg.				-0.006	126.1	3.01

B: bluegills; C: catfish
(1) Number indicates order of feeding and/or territorial dominance determined by observation; date refers to period during 01/18-27 for which fish was isolated by screen. Isolated fish were fed approximately 1/3 of daily feed.

Fish Weights and Amount of Pellets Fed in Aquaria

Tank No.	Fish No.	Comments(1)	Fish wt, g Start	End	Weight gain, d^{-1}	Amount fed, g	Feeding ratio g/d. 100 g.wt.
1(C)	1-1		166.0	163.0	-0.002		
	1-2		158.0	148.0	-0.007		
	1-3		158.0	149.6	-0.006		
	Avg.				-0.005	16.8	0.41
2(B)	2-1	3	---	86.5	---		
	2-2	2	---	80.2	---		
	2-3	1 02/08-17	104.5	115.8	0.011		
	Avg.					10.5	0.41
3(C)	3-1		178.5	150.5	-0.019		
	3-2		137.5	118.2	-0.017		
	3-3		169.0	140.8	-0.020		
	Avg.				-0.019	17.7	0.48
4(C)	4-1		150.0	154.8	0.003		
	4-2		133.7	134.6	0.001		
	4-3		173.0	163.2	-0.005		
	Avg.				0.000	25.0	0.62
5(C)	5-1		163.0	148.5	-0.010		
	5-2		122.3	126.4	0.004		
	5-3		141.5	140.0	-0.001		
	Avg.				-0.002	32.8	0.88
6(B)	6-1	---	86.5	75.6	-0.015		
	6-2	---	94.4	86.2	-0.010		
	6-3	1	94.5	105.7	0.012		
	Avg.				-0.004	19.0	0.79
7(C)	7-1		182.0	181.4	0.000		
	7-2		210.0	212.4	0.001		
	7-3		171.0	180.0	0.006		
	Avg.				0.002	17.5	0.34
8(C)	8-1		165.0	171.5	0.004		
	8-2		146.0	133.7	-0.010		
	8-3		152.5	146.3	-0.005		
	Avg.				-0.004	32.3	0.80

B: bluegill; C: catfish

(1) Number indicates order of feeding and/or territorial dominance determined by observation; date refers to period during 02/08-17 for which fish was isolated by screen. Isolated fish was fed approximately one-third of daily feed.

B.5-1

Weight Balances for Dissected Bluegill & Catfish, Worm-fed in Aquaria

Fish No.	Total Wet Weight, g Sum	Death Weight	Percent
	Bluegill		
1-1	141.6	149.3	94.8
1-2	103.4	111.0	93.2
1-3	100.4	107.9	93.1
2-1	84.3	88.8	95.0
2-2	84.9	91.2	93.1
2-3	153.5	161.2	95.2
3-1	88.1	91.0	96.8
3-2	93.4	97.6	94.3
3-3	161.4	172.8	93.4
4-1	103.1	110.0	93.8
4-2	82.8	87.8	94.3
4-3	139.7	147.6	94.6
5-1	99.1	111.7	88.8
5-2	114.2	122.0	93.6
5-3	130.5	146.3	89.2
6-1	---	---	---
6-2	68.8	74.3	92.7
6-3	94.3	100.3	94.0
6-4	165.2	169.1	97.7
	Catfish		
7-1	246.2	262.4	93.8
7-2	146.8	152.5	96.2
7-3	151.7	160.6	94.5
8-1	147.2	156.1	94.3
8-2	137.9	147.6	93.4
8-3	151.8	161.2	94.2

B.5-2

Weight Balances for Dissected Bluegill & Catfish, Pellet-fed in Aquaria

Fish No.	Total Wet Weight, g Sum	Death Weight	Percent
		Catfish	
1-1	156.0	163.0	95.7
1-2	142.0	148.0	95.9
1-3	143.1	149.6	95.6
3-1	144.2	150.5	95.8
3-2	113.3	118.2	95.8
3-3	134.5	140.8	95.5
4-1	148.5	154.8	96.0
4-2	128.9	134.6	96.2
4-3	157.1	163.2	96.3
5-1	141.0	148.5	94.9
5-2	120.2	126.4	95.1
5-3	134.3	140.0	95.5
7-1	170.6	181.4	94.0
7-2	202.3	212.4	95.2
7-3	171.6	180.0	95.3
8-1	163.3	171.5	95.2
8-2	124.7	133.7	93.0
8-3	139.2	146.3	95.2
		Bluegill	
2-1	83.2	86.5	96.2
2-2	74.8	80.2	93.3
2-3	110.3	115.8	95.3
6-1	71.7	75.6	94.9
6-2	80.1	86.2	93.7
6-3	101.5	105.7	96.0

C.1
Non-food Uptake of 32-P

Fish No.(1)	Date of death,(2) 1982 (hr)	Weight,(3)			Sample No.	P-32					
		wet	dry	ashed		Date of counting, 1982 (hr)	decay fraction	net c/min	c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg.
						Bluegill Muscle					
683 B	12/10	57.7	11.2	714	927	12/21(20)	0.577	174	26.1	2.51	10.4
857 B	(12)	70.4	14.2	854	926	12/22(09)	0.562	196	24.8	2.40	10.3
626 U		40.8	7.94	529	965	12/23(07)	0.537	33.5	7.6	2.54	3.0
628 U		22.1	4.44	298	917	12/19(10)	0.649	26.3	9.2	2.50	3.7
638 U		11.8	2.34	154	967	12/23(08)	0.537	22.0	17.4	2.61	6.7
878 U		38.5	7.59	509	920	12/19(14)	0.644	68.9	13.9	2.72	5.1
						Catfish Muscle					
210.1 B	12/17	61.4	14.0	725	1087	01/13(04)(4)	0.274	74.3	22.1	2.42	9.1
160.4 B	(11)	51.0	11.9	591	1072	01/12(08)	0.285	86.4	29.7	2.42	12.3
150.7 B		49.6	11.4	---	Lost	---	---	---	---	---	---
137.0 U		33.7	9.62	485	1086	01/13(01)	0.275	27.6	18.2	2.99	6.1
117.4 U		35.8	8.09	413	1064	01/11(20)	0.292	26.8	12.8	2.56	5.0
128.0 U		38.3	8.90	436	1079	01/12(17)	0.280	37.1	17.3	2.36	7.3

Notes: (1) B: blocked esophagus; U: unblocked
(2) Bluegill exposure began on 12/6 (1700) except for 857 and 878 which were exposed from 12/8(11) to 12/12(11); catfish exposure began on 12/13(1100).
(3) Wet and dry weight in gram; ashed weight in mg.
(4) Month 01 is in 1983.
(5) Bluegill skeleton includes tail; catfish skeleton includes fin spines, and head includes fins.
(6) Weight appears to be erroneous.

C.1 cont'd
Non-food Uptake of 32-P

Fish No.(1)	Date of death, 1982(hr)	Weight, wet	dry	ashed	Sample No.	P-32 Date of counting, 1982 (hr)	decay fraction	net c/m	c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg.
						Bluegill Skeleton (5)					
683 B	12/10	58.7	6.4	5,104	968	12/23(10)	0.534	535.	85.3	18.7	4.56
857 B	(12)	45.7	14.9	4,557	1094	01/14(16)	0.200	188.	103.	16.3	6.32
626 U		41.4	2.1	4,360	1049	01/11(06)	0.214	53.7	30.3	21.6	1.40
628 U		20.9	4.09	1,317	1051	01/11(08)	0.214	22.0	24.6	11.0	2.24
638 U		8.1	2.37	753	976	12/24(15)	0.504	67.6	82.8	16.4	5.05
878 U		44.2	3.2	4,674	1055	01/11(13)	0.212	89.9	48.0	21.7	2.21
						Catfish Skeleton (5)					
210.1 B	12/17	31.0	10.8	1,940(6)	1084	01/12(23)	0.277	82.7	48.2	13.4	3.59
160.4 B	(11)	24.8	8.32	948	1071	01/12(06)	0.286	97.6	68.8	7.51	9.16
150.7 B		22.4	7.65	878	1044	01/11(23)	0.291	61.4	47.1	7.65	6.16
137.0 U		33.7(6)	7.02	807	1095	01/13(20)	0.265	19.7	11.0	4.47(6)	2.46
117.4 U		20.0	6.43	770	1063	01/11(18)	0.293	21.2	18.1	7.20	2.51
128.0 U		21.0	7.05	872	1067	01/12(01)	0.289	32.0	26.4	7.11	3.71

C.1 cont'd
Non-food Uptake of 32-P

Fish No.(1)	Date of death, 1982(hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32: Date of counting, 1982 (hr)	P-32: decay fraction	P-32: net c/m	P-32: c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg.
						Bluegill Scales and Skin					
683 B	12/10	31.3	13.2	5,928	977	12/24(17)	0.502	536.	171.	54.5	3.14
857 B	(12)	23.7	9.77	4,125	1050	01/07(16)	0.255	212.	175.	45.8	3.82
626 U		23.5	9.65	4,323	978	12/24(18)	0.501	80.6	34.2	55.7	0.61
628 U		6.2	2.27	693	1085	01/13(01)	0.217	11.5	42.7	27.7	1.54
638 U		4.9	1.51	373	975	12/24(14)	0.505	47.2	95.4	21.0	4.54
878 U		24.2	10.0	4,325	1056	01/11(15)	0.211	82.0	80.3	44.3	1.81
						Catfish Skin					
210.1 B	12/17	17.6	5.59	149	1092	01/13(06)	0.273	26.6	27.7	2.40	11.5
160.4 B	(11)	12.2	3.73	92.9	1062	01/11(17)	0.294	25.8	36.0	1.73	20.8
150.7 B		8.8	2.58	53.9	1048	01/11(04)	0.302	14.5	27.3	1.76	15.5
137.0 U		11.7	3.92	108	1093	01/13(18)	0.266	5.8	9.3	2.55	3.65
117.4 U		11.4	3.18	91.1	1066	01/11(23)	0.291	6.8	10.2	2.10	4.86
128.0 U		13.3	4.57	98.1	1065	01/11(22)	0.291	11.8	15.2	1.88	8.09

C.1 cont'd
Non-food Uptake of 32-P

Fish No.(1)	Date of death, 1982(hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32 Date of counting, 1982 (hr)	P-32 decay fraction	P-32 net c/m	P-32 c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg.
						Bluegill Head					
683 B	12/10	78.2	21.7	7,137	928	12/22(10)	0.561	563.	64.2	18.8	3.41
857 B	(12)	65.9	20.1	5,912	1057	01/07(13)	0.257	268.	79.1	19.2	4.12
626 U		69.9	19.3	6,733	929	12/21(22)	0.575	94.4	11.7	20.2	0.58
628 U		21.5	5.60	1,489	1046	01/11(01)	0.217	28.6	30.7	16.5	1.86
638 U		13.6	3.54	972	930	12/21(23)	0.575	122.	78.0	18.2	4.29
878 U		64.7	18.2	6,176	980	12/24(20)	0.499	163.	25.2	20.6	1.22
						Catfish Head					
210.1 B	12/17	61.6	18.7	5,170	1103	01/14(10)	0.258	181.	56.9	19.1	2.98
160.4 B	(11)	42.2	12.5	2,484	1074	01/07(14)	0.358	275.	91.0	12.1	7.52
150.7 B		38.5	12.1	2,307	1061	01/07(14)	0.358	206.	74.7	14.1	5.30
137.0 U		36.7	11.6	2,159	1104	01/14(12)	0.245	34.5	19.2	13.0	1.48
117.4 U		34.5	10.3	1,927	1075	01/12(12)	0.283	42.9	22.0	12.8	1.72
128.0 U		36.5	12.1	2,437	1073	01/12(09)	0.285	80.0	38.5	14.4	2.67

C.1 cont'd
Non-food Uptake of 32-P

Fish No.(1)	Date of death, 1982(hr)	Weight, wet	Weight, dry	Weight, ashed	Sample No.	P-32: Date of counting, 1982 (hr)	P-32: decay fraction	P-32: net c/m	P-32: c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg.
Bluegill Viscera											
683 B	12/10	12.4	2.61	146.	971	12/23(11)	0.533	1,506	1,139	2.40	475
857 B	(12)	11.2	2.90	91.5	973	12/23(12)	0.533	1,281	1,073	2.03	529
626 U		8.1	1.44	92.0	986	12/23(13)	0.533	185	214	1.87	114
628 U		2.2	0.376	23.8	969	12/24(10)	0.509	141	630	1.95	323
638 U		1.8	0.318	19.8	974	12/23(12)	0.533	223	1,162	2.62	444
878 U		8.1	1.56	93.7	1052	01/07(16)	0.255	215	520	2.61	199
Catfish Viscera											
210.1 B	12/17	15.1	3.29	134.	1100	01/14(05)	0.261	122.	155.	2.29	67.7
160.4 B	(11)	14.4	4.64	115.	1069	01/07(16)	0.356	277.	270.	1.97	137
150.7 B		15.3	5.87	103.	1047	01/11(02)	0.303	63.6	68.6	2.76	24.9
137.0 U		12.8	5.94	86.8	1099	01/14(03)	0.262	44.1	65.8	1.63	40.4
117.4 U		9.3	4.13	60.6	1076	01/12(14)	0.282	63.6	121.	1.78	68.0
128.0 U		12.1	5.22	82.6	1077	01/07(15)	0.358	135.	156.	1.85	84.3

C.1 cont'd
Non-food Uptake of 32-P

Fish No.(1)	Date of death, 1982(hr)	Weight, wet	dry	ashed	Sample No.	P-32: Date of counting, 1982 (hr)	decay fraction	net c/m	c/min.g. wet	P, mg/g wet	P-32/P, c/min.mg.
Bluegill Gills											
683 B	12/10	1.38	0.201	15.1	985	12/25(03)	0.492	38.8	286	2.38	120
857 B	(12)	1.09	0.168	12.9	914	12/19(06)	0.654	64.4	452	3.48	130
626 U		1.04	0.154	12.8	970	12/24(12)	0.507	6.2	58.8	2.82	20.9
628 U		0.21	0.036	2.6	915	12/19(07)	0.653	3.0	109	3.17	34.4
638 U		0.13	0.021	0.2	912	12/19(02)	0.660	2.1	122	3.42	35.7
878 U		0.92	0.138	8.3	913	12/19(04)	0.657	17.7	146	2.83	51.6
Catfish Gills											
210.1 B	12/17	1.27	0.237	10.4	1082	01/12(20)	0.279	7.7	109	2.64	41.3
160.4 B	(11)	0.75	0.137	4.9	1068	01/12(03)	0.288	5.4	125	2.74	45.6
150.7 B		0.97	---	6.1	1053	01/11(10)	0.298	6.7	116	2.69	43.1
137.0 U		1.05	0.207	7.7	1097	01/13(24)	0.263	<2.2	<40	3.39	< 12
117.4 U		0.69	0.128	4.4	1078	01/12(15)	0.281	<2.2	<57	2.71	< 21
128.0 U		0.49	0.133	5.6	1070	01/12(04)	0.288	<2.2	<78	5.14	< 15

P-32 Concentration in Water for Test of Non-food Uptake

Date of death, 1982 (hr)	Vial No.	Description	P-32				P,	P-32/P,
			date counted	decay fraction	net c/min	c/min.ml	mg/L	c/min.mg
Bluegill								
12/10	10	Initial	12/11(11)	0.955	6,633	347	5.44	63,800
(12)	11	Final T1	12/11(12)	0.953	6,659	349	5.58	62,500
	12	Final T2	12/11(14)	0.949	6,716	354	5.52	64,100
	13	Final T3	12/16(23)	0.806	5,145	319	5.88	54,300
	14	Final T4	12/16(24)	0.804	5,184	322	5.40	59,600
		Average Final				320	5.64	57,000
Catfish								
12/17	20	Initial	12/17(14)	0.994	7,198	362	5.40	67,000
(11)	21	Final T1	12/17(14)	0.994	7,332	369	5.44	67,800
	22	Final T2	12/17(15)	0.992	7,017	354	5.66	62,500
	23	Final T3	12/17(15)	0.992	6,979	352	5.59	63,000
	24	Final T4	12/17(15)	0.992	6,967	351	6.10	57,500
		Average Final				352	5.84	60,200

Notes: 1. Fish were 2 days in Tanks 1 or 2 and then 2 days in Tanks 3 or 4.
2. Each tank contained 48 L water; 464 g NaH_2PO_4 and 549 g Na_2HPO_4 were dissolved in each tank to obtain a phosphorus concentration of 5.0 mg/L, equimolar in the two species at pH 7.0.

C.3

Bluegill and Catfish Wet Weights in 4-Day Test of Non-food Uptake

Bluegill

Fish Number	Weight, g Start	Weight, g End	Weight gain, d⁻
683 B	255.7	(265.4)?	----
857 B	237.4	239.2	0.002
626 U	196.6	193.5	-0.004
628 U	73.0	70.1	-0.010
638 U	43.7	42.6	-0.006
378 U	193.8	190.5	-0.004
Avg. B		246.	----
Avg. U		124.	-0.006

Catfish

Fish Number	Weight, g Start	Weight, g End	Weight gain, d⁻
210.1 B	217.8	210.1	-0.009
160.4 B	168.5	160.4	-0.012
150.7 B	154.6	150.7	-0.006
137.0 U	139.1	137.0	-0.002
117.4 U	122.5	117.4	-0.010
128.0 U	137.4	128.0	-0.018
Avg. B		173.	-0.009
Avg. U		127.	-0.010

C.4

Weight Balances for Dissected Bluegill & Catfish, Unfed in Aquaria

Fish No.	Total Wet Weight, g		
	Sum	Death Weight	Percent
		Bluegill	
683 B	239.7	(265.4)?	(90.3)?
857 B	218.0	239.2	91.1
626 U	184.8	193.5	95.5
628 U	73.1	70.1	104.3
638 U	40.3	42.6	94.7
878 U	180.6	190.5	94.8
		Catfish	
210.1 B	188.0	210.1	89.5
160.4 B	145.4	160.4	90.6
150.7 B	135.4	150.7	89.8
137.0 U	129.6	137.0	94.6
117.4 U	111.7	117.4	95.1
128.0 U	121.7	128.0	95.0

Appendix D.1

Pellet Contents Reported by Supplier

Element	%
Na	0.5
K	0.9
Mg	0.2
Ca	1.6
P	1.0
Cl	0.9

Notes: 1. Pellets are Purina Trout Chow L.F., purchased July 17, 1982.
2. Values are approximations based on ingredients.
3. Basis is "dry weight" which is 90% dry matter.

Appendix D.2

Phosphate Concentration in Atlanta Water
Reported by Treatment Plant

Month	Water plant sample, mg/L	Distribution system sample, mg/L
Nov. 82	0.68 (0.07 - 1.60)(1)	0.45 (Nov. 22)(2)
Dec. 82	0.49 (0.26 - 0.74)	0.38 (Dec. 30)
Jan. 83	0.43 (0.11 - 0.78)	0.48 (Jan. 31)
Feb. 83	0.70 (0.45 - 0.85)	0.44 (March 1)

Notes: (1) average of daily values (range in parentheses)
(2) collected at indicated date from nearest sampling point (Luckie and Hunnicutt Sts.) to Georgia Tech

Appendix E

General Equation for Calculating Specific Activity in a Compartment

The following calculation applies to an open, non-steady-state system with rapidly decaying radionuclide. The approach is based on the compartmental model for a closed system and long-lived radionuclide (Be75).

Growth rate in compartment t:

$$\frac{dQ_t}{dt} = \sum_{s=1}^{n} R_{st} - \sum_{s=1}^{n} R_{ts} + R_{ft} - R_{tx} \qquad (E1)$$

Change of count rate in compartment t:

$$\frac{dq_t}{dt} = \sum_{s=1}^{n} R_{st}\, a_s - a_t \sum_{s=1}^{n} R_{ts} + R_{ft}\, a_f - R_{tx}\, a_t - q_t\, \lambda_r \qquad (E2)$$

Relation among change with time in count rate, amount, and specific activity:

$$\frac{dq_t}{dt} = \frac{d(Q_t a_t)}{dt} = Q_t \frac{da_t}{dt} + a_t \frac{dQ_t}{dt} \qquad (E3)$$

Solution for da_t/dt based on equations (E1), (E2), and (E3):

$$\frac{da_t}{dt} = \sum_{s=1}^{n} \frac{R_{st}}{Q_t} a_s - a_t \sum_{s=1}^{n} \frac{R_{ts}}{Q_t} + a_f \frac{R_{ft}}{Q_t} - a_t \frac{R_{tx}}{Q_t} - \frac{q_t}{Q_t} \lambda_r$$

$$- a_t \sum_{s=1}^{n} \frac{R_{st}}{Q_t} + a_t \sum_{s=1}^{n} \frac{R_{ts}}{Q_t} - a_t \frac{R_{ft}}{Q_t} + a_t \frac{R_{tx}}{Q_t}$$

$$= \sum_{s=1}^{n} \frac{R_{st}}{Q_t} a_s - a_t \sum_{s=1}^{n} \frac{R_{st}}{Q_t} + a_f \frac{R_{ft}}{Q_t} - a_t \frac{R_{ft}}{Q_t} - a_t \lambda_r \qquad \text{(E4)}$$

If R_{ft} is considered simply another rate, R_{st}:

$$\frac{da_t}{dt} = \sum_{s=1}^{n} \frac{R_{st}}{Q_t} a_s - a_t \sum_{s=1}^{n} \frac{R_{st}}{Q_t} - a_t \lambda_r$$

Definitions:

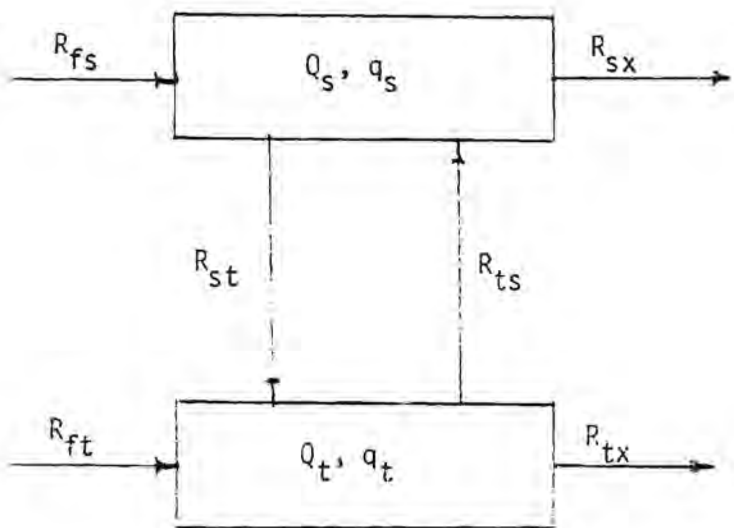
- Q_t: amount of phosphorus in compartment t, mg
- q_t: P-32 in compartment t, count/min
- a_t: P-32 specific activity in compartment t, count/min.mg
  ($a_t = q_t/Q_t$)
- R_{st}: transport rate of phosphorus from compartment s into t, mg/d
- t: time, d
- λ_r: radioactive decay constant of P-32, d^{-1}

subscripts: t: compartment of interest

s: any other compartment

f: feed

x: excretion



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16. ABSTRACT (200 words or less)

Bluegill and catfish maintained in flow-through tanks were fed P-32 at two feeding levels. Fish were analyzed in triplicate for P-32 and phosphorus at intervals of 1 - 8 days. Additional aquaria experiments were performed to determine the effects of other factors and to observe P-32 uptake from water by unfed fish (including fish with blocked esophagus). The bluegill showed a weight gain of 0.2 %/d, a phosphorus turnover constant in muscle of 0.43 %/d, and a BF_r/BF ratio of 0.081 at the higher feeding rate, and 0.05 %/d, 0.34 %/d, and 0.064 at the lower feeding rate. Hence, respective P-32 BF_r values are 6,000 and 4,000 at a phosphorus BF of 70,000. The BF_r values for catfish were approximately twice as high. The aquarium experiments suggest that the higher factors are due to a much higher phosphorus intake, higher water temperature, higher retention from pellets than from worms, and possible higher retention by catfish than bluegill under the same conditions.

17. KEY WORDS AND DOCUMENT ANALYSIS
Bioaccumulation Factor
Fish
Phosphorus-32

17a. DESCRIPTORS
BF
Bluegill, Catfish
P-32

17b. IDENTIFIERS/OPEN-ENDED TERMS

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